PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

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RELATED SUBJECTS CONTAINED IN SECTION B (ELECTRICAL ENGINEERING ABSTRACTS)

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Non-destructive testing
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Electronic relays and counters
Automatic control mechanisms
Applied electrochemistry
Photocells
Thermionic tubes
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X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the left. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, ":" e.g. "536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0 : 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

[*Continued on page 3 of cover*

MATHEMATICS 51

86 : 530.145 2748

n equation of quantum mechanics. LITTLEWOOD, D. E. . *Camb. Phil. Soc.*, **43**, 406–13 (*July*, 1947).—The set uantities $\beta_1, \beta_2, \ldots \beta_n$ satisfy the Duffin commutation ions $\beta_i\beta_j\beta_k + \beta_k\beta_j\beta_i = g_{ij}\beta_k + g_{jk}\beta_i$. For both 2ν and $n = 2\nu + 1$ there are $(\nu + 1)$ irreducible ix representations, but for $n = 2\nu + 1$ there are in tion two conjugate representations. Explicit esentations are given for $n = 2, 3, 4, 5$. G. J. K.

5 2749

ecent developments in calculating machines. HARTREE, R. *J. Sci. Instrum.*, **24**, 172–6 (*July*, 1947).—Dis- uishes between "instruments," which deal with inuously varying quantities, and "machines," which with quantities varying by discrete steps; this latter may be designed to work to any finite degree of uracy. A new differential analyser is described, in ch the individual units are mechanical as in previous ruments, but the couplings are electrical. Other ruments mentioned are intended for heat flow blems and the determination of Fourier transforms. principles of design of machines are discussed; most ent advances are in this class, and those at Harvard the Bell laboratories are described. The ENIAC, ended for external ballistics problems, has a wider field pplication, and has shown the need for greater storage acity and for a means of automatically supplying the chine with its operating instructions. N. C.

.5 = 3 2750

olution of eigenvalue problems, using punched-card chines. KIND-SCHAAD, G. *Schweiz. Arch. angew. ss. Tech.*, **13**, 161–8 (*June*, 1947) *In German.*—An plication of the Hollerith system to the calculation of envalues, or latent roots of a matrix. N. L. J.

8.5 : 531.558 2751

The ballistic computer. JULEY, J. *Bell Lab. Rec.*, **25**, (*Jan.*, 1947).—Calculating machines fall into two main categories: (*a*) analogue machines in which numbers are represented by physical quantities; (*b*) digital machines in which numbers are directly handled in digital form. The ballistic computer is a cross between (*a*) and (*b*), developed for anti-aircraft purposes; the numbers are handled digitally, but the computing elements are electromagnetic relays. It computes exactly where the plane and shell would be at the time of shell-burst, from information fed to it from four tapes. P. O.

518.5 : 621.317.39 2752

Continuous electrical computation. LOVELL, C. A. *Bell Lab. Rec.*, **25**, 114–18 (*March*, 1947).—[Abstr. 2453 B (1947)].

518.5 : 621.318.5 2753

A relay computer for general application. WILLIAMS, S. B. *Bell Lab. Rec.*, **25**, 49–54 (*Feb.*, 1947).—The article describes a general purpose relay computer whose principle of operation is similar in detail to the Ballistic Computer. It uses standard U-type relays and provides temporary storage of numbers, teletype tape-reading apparatus for feeding numerical and other data and a teletype page printer for recording the solutions. A problem tape introduces numerical data of the particular problem; a table tape carries function tables to which reference is made during the computation; and a routine tape directs the various operations in appropriate sequence. Considerable attention has been paid to checking electrical and other faults as they occur, and operating experience indicates that a very high degree of reliability has been attained. P. O.

519.24 : 621.318.57 2754

On the statistical treatment of counter data. HOLE, N. *Ark. Mat. Astr. Fys.*, **34 B** (*Paper* 20) 8 *pp.* (1947).—A condensed survey of methods of correcting for finite resolving power, followed by special consideration of two counters connected by a scaling circuit. N. L. J.

ASTRONOMY . ASTROPHYSICS . GEODESY 52

1.038 : 523.87 2755

Magnetic fields of astronomical bodies. BABCOCK, W. *Phys. Rev.*, **72**, 83 (*July* 1, 1947).—Following the eeman effect measurements of 78 Virginis [Abstr. 1413 947)] the author has now made a similar measurement an A-type star BD–18°3789 (HD 125248) leading to olar magnetic field of 5 500 gauss. It is further pointed t that the magnetic dipole moment of the earth, sun d 78 Virginis are proportional to their angular momenta. If such a relation can also be applied to a galaxy, en the Andromeda nebula should have a field of $^{-8}$ gauss parallel to its axis of rotation. W. E. D.

1.042 : 539.152.1 = 4 2756

On the formation of heavy elements. LACROUTE, P. *R. Acad. Sci., Paris*, **224**, 1481–3 (*May* 28); 1541–3 *June* 2, 1947) *In French.*—It is suggested that van lbada's theory could explain the formation of nuclei ith reduced charge and $A > 150$ if account is taken of eutron degeneracy. [See Abstr. 2378 (1947)]. Evidence presented in support of the hypothesis that heavy uclei are formed with reduced charges, and attain their ctual values of A and Z by β-transformations. R. A. N.

23.161 : 533.6.011 2757

Aerodynamical problems connected with the motion of cloud of gas emitted by Nova Persei. I–III. BURGERS, J. M. *Proc. K. Ned. Akad. Wet.*, **50** (*No.* 3) 262–71; (*No.* 4) 332–8; (*No.* 5) 442–51 (1947).—The cloud is treated as a thin plane sheet which impinges upon interstellar gas of much smaller density. Compression waves sent out in the gas are studied by the methods of a previous paper [Abstr. 2229 (1946)], and expressions are obtained for the speed and retardation of the cloud. In III an expression is obtained for the rate of flow of heat by conduction from the gas to the cloud, and the energy balance for the cloud is discussed. R. A. N.

523.5 : 551.594.9 : 621.396.99 2758

Radio reflexions from meteoric ionization. HEY, J. S. *Nature, Lond.*, **160**, 74–6 (*July* 19, 1947).—Report of a Physical Society meeting (Jan. 31, 1947). Recent observations on ionization bursts and radar echoes (largely reported elsewhere) were discussed.

523.5 : 551.594.9 : 621.396.99 2759

Meteors, comets and meteoric ionization. LOVELL, A. C. B. *Nature, Lond.*, **160**, 76–8 (*July* 19, 1947).—Report of a Physical Society meeting (March 19–20, 1947). The general state of knowledge of meteors and comets was reviewed, and recent radio and radar observations reported (largely in course of publication elsewhere). An account of theoretical aspects of meteor ionization was also included.

523.6 : 537.591.15 *see Abstr.* 2932

523.72 2760

Relation between the intensity of solar radiation on 175 Mc/s and 80 Mc/s. RYLE, M., AND VONBERG, D. D. *Nature, Lond.*, **160**, 157–9 (*Aug.* 2, 1947).—Observations were made using earlier apparatus [Abstr. 2743 (1946)] on the two frequencies simultaneously. There is no coincidence of short-lived bursts, but many larger bursts occur on both frequencies. A day-to-day plot of the ratio of equivalent source temps. of the two frequencies has a much smaller range of variation than that of the temps. themselves, and abnormal values tend to recur with a period of ~ 27 days. It is concluded that directed emission, with "polar diagram" dependent on frequency, is an important factor.

523.72 : 550.385 2761

A slow corpuscular radiation from the sun. KIEPENHEUER, K. O. *Astrophys. J.*, **105**, 408–23 (*May*, 1947).—See Abstr. 1395 (1947). For *Lyα*, read *Lα*.

523.745 : 551.593 : 525.75 = 4 *see Abstr.* 2763

523.75 : 550.386 = 4 2762

Magnetic effects of visible solar eruptions. BERNARD, P. *C.R. Acad. Sci., Paris*, **224**, 1811–13 (*June* 30, 1947) *In French.*—A recent visible eruption is found to have been followed by perturbations in the earth's magnetic field. A possible explanation of the retardation of the magnetic effects is suggested. R. A. N.

523.87 : 521.038 *see Abstr.* 2755

523.87 : 535.343.1 *see Abstr.* 2836

525.75 : 523.745 : 551.593 = 4 276

Relations between solar activity and brightness of th high terrestrial atmosphere. CABANNES, J., DUFAY, J. AND TCHENG, M.-L. *C.R. Acad. Sci., Paris*, **224**, 1393– (*May* 19, 1947) *In French.*—Results obtained fron measurements over 14 months on the bands 4 424 an 4 170 Å of the *A–X* system for N and over 3 years on th rays 5 577 and 6 300 Å of O as well as the Na double 5 892 Å are given. A notable correlation is foun between the variation for the ray 5 577 Å from its month mean intensity and that for sunspot variations. Th max. positive excess for 5 577 Å occurs 1–2 days afte a group of sunspots passes the central solar meridian There is also a 27-day period for this ray in agreemen with the period for the sun's rotation. Little relation i found for the other rays examined. R. S. R

525.75 : 535.338.4 = 4 276

The negative bands of nitrogen in the spectrum of th twilight sky. DUFAY, M., AND DUFAY, J. *C.R. Aca Sci., Paris*, **224**, 1834–6 (*June* 30, 1947) *In French.*— The First Negative bands of N_2^+ have been observed a the Observatories of Haute Provence and Lyon. Th occurrence of the bands in the twilight sky is irregula and appears to be related to magnetic activity. A. G. C

PHYSICS 53

53.08 = 4 2765

Experimental study of systems with a large number of parameters. I. Theory. RENAUD, P. *J. Phys. Radium (Sér. 8)* **7**, 281–6 (*Oct.*, 1946) *In French.*—The experimental study of a quantity depending on n parameters involves $a_1 a_2 \ldots a_n$ measurements, where a_i is the necessary number of values of the ith parameter. If the time required for the adjustment of the ith parameter is t_i and the time for the measurement of the quantity is θ, the total time required for the investigation is $a_1 t_1 + a_1 a_2 t_2 + \ldots + a_1 a_2 \ldots a_n (t_n + \theta)$. The experiment should therefore be designed so that θ is as small as possible, and the order in which the parameters are adjusted is such that $t_n < t_{n-1} < \ldots$. If one of the a's is considerably smaller than the rest it may be desirable to make the corresponding parameter the first to be adjusted, even if it is not the one with the largest t.

A. J. C. W.

II. Applications. *Ibid.*, 333–6 (*Nov.*, 1946).

53.081 : 621.3.081 = 4 2766

Dimensional consistency between theoretical and practical units. BODEA, E. *Bull. Ass. Suisse Élect.*, **38**, 222–9 (*April* 19, 1947) *In French.*—Using the Kalantaroff (*LTQΦ*) system it is shown that the Giorgi m.k.s. system of units has both practical and theoretical superiority over the c.g.s. system since it has dimensional consistency throughout. E. O. T.

FUNDAMENTALS 530.1

530.12 : 531.18 2767

The relativistic clock problem. HILL, E. L. *Phys. Rev.*, **72**, 236–40 (*Aug.* 1, 1947).—The theory of uniformly accelerated motions based on the conformal group of transformations in space-time is applied to the clock problem of relativity theory. Two solutions are found, both of which are at variance with the usual theory. The bearing of the problem on the relation between mechanics and electromagnetic theory is discussed briefly. A.

530.12 : 531.18 : 537.122 276

On the kinematics of uniformly accelerated motions an classical electromagnetic theory. HILL, E. L. *Phys. Rev* **72**, 143–9 (*July* 15, 1947).—In continuation of earlie work [Abstr. 2737 (1945)] a study is made of the 4 dimensional conformal group of transformations in space time as the extension of the Lorentz group permittin the introduction of uniformly accelerated reference frame into relativity theory. The problem of the motion of particle is discussed, as well as the implications for th classical-type electron theory developed by Dirac. A

530.12 : 531.51 276

The physical significance of Birkhoff's gravitation equations. IVES, H. E. *Phys. Rev.*, **72**, 229–32 (*Aug.* 1947).—Birkhoff's gravitational equations are put i terms of dt in place of the local time ds used by hin The transformed equations show that Lorentzian mas has been used, and to the Newtonian attractive force added a force normal to the direction of motion, v^2/c times the component of the gravitational force normal t the motion. A

530.14 277

Relativistic Hamiltonian system of a particle an relativistic Heisenberg's equation. TZOU, K. H. *Chi J. Phys.*, **7**, 9–20 (*June*, 1947).—A new set of corr sponding relativistic equations is set up, as suggested b the classical canonical equations. Therefrom a relativisti form of Heisenberg's equation is deduced. The relativisti Hamiltonian system of a particle according to the formul tion here established is fully discussed and by followin it Dirac's equation appears naturally as a necessary fort of relativistic wave equation for the electron in quantur mechanics. The process of taking the square root i Dirac's theory is seen to have its classical analog Finally, some applications of the relativistic Heisenber equation to Dirac's theory are discussed and it is thereb pointed out that this equation makes some quantiti more symmetrical in the relativity sense and also som

re general than those the non-relativistic equation introduce. A.

.14 2771

he vector mesotron. BARTLETT, J. H. *Phys. Rev.*, **72**, -24 (*Aug.* 1, 1947).—The wave equations of Proca a vector mesotron (spin 1) are specialized first to the e in which there is no magnetic field, and then to that which the field is central. The wave functions satisfy -order homogeneous differential equations. For the es $l = j \pm 1$, it is simpler to consider two simultaneous l-order differential equations in two unknowns. a coulomb field, the form of the radial functions at 0 is established as $u = \exp[-aL/r^{\frac{1}{2}}]r^{\beta}f$, where $2(z\alpha)^{\frac{1}{2}}[j(j+1)]^{\frac{1}{4}}$, $L^2 = \hbar/Mc$, M = rest mass of sotron, f is an ascending power series in r, ze is the rge on the coulomb source, α is the fine-structure stant $e^2/\hbar c$, and β is a constant which can be ermined. A.

.14 = 4 2772

On the general principles of a new unitary field theory. TIAU, G. *J. Phys. Radium* (*Sér.* 8) **7**, 226–7 (*Aug.*, 46) *In French.*—The equation of general relativity ing the curvature of space is modified if matter is no ger adequately described by a symmetric tensor, ause of spin and other properties. Modifications for rticles of spin 2 are discussed. G. J. K.

.14 : 539.152.1 2773

On the meson theory of nuclear forces. FOLDY, L. L. *vs. Rev.*, **72**, 125–30 (*July* 15, 1947).—The failure of Møller–Rosenfeld–Schwinger mixture to yield antitative agreement with the observed properties of proton-neutron system suggests the possibility that s agreement might be obtained with other such mixtures which tensor force singularities are cancelled. Several ch possibilities exist, involving vector, pseudo-vector, d pseudoscalar mesons, certain of which possess the aracteristic that they yield a finite tensor and central eraction in the limit where the meson masses approach uality and the square of the coupling constant increases definitely inversely as the difference in masses. The sultant interaction is of an especially simple form, and lculations were made on the proton-neutron and proton-oton systems in spite of admitted conceptual difficulties ncerning the result. These calculations indicated that isfactory agreement with experimental results cannot obtained with these limiting forms of the interaction, the mass of observed cosmic ray mesons is employed the theory. Substantially better agreement can be tained with a meson mass ~ 300 electron masses. A.

.14 : 539.152.1 2774

Effect of Pais' "*f*-field" on the symmetry of the eson field part of nuclear Hamiltonian. ZILSEL, P. R., AIR, J. S., AND POWELL, J. L. *Phys. Rev.*, **72**, 225–8 ug. 1, 1947).—If an "*f*-interaction" is introduced into e Hamiltonian for two protons, the square well of idth e^2/mc^2 representing the specific nuclear proton-oton interaction at low energies must be modified to mpensate for the effect of the "*f*-interaction." It is und that the experimental dependence of phase shift n energy for low energy proton-proton *S*-scattering ould require the assumption of different well depths for fferent energies of the incident protons. The necessary anges in the potential would be sufficiently large to stroy the symmetry between the specific nuclear proton-oton and proton-neutron ^1S interactions. A.

30.145 = 4 2775

Systems of wave-equations realising an irreducible presentation of the Lorentz group. POTIER, R. *C.R. Acad. Sci., Paris*, **224**, 1332–4 (*May* 12, 1947) *In French.*—Particles of spin $(p + \frac{1}{2})$ are described by wave-functions forming a basis of a representation of degree $2p(p+1)$, with a spectrum of proper masses. G. J. K.

530.145 = 5 2776

The fundamental laws of classical and quantum statistical mechanics. CALDIROLA, P. *Riv. Nuovo Cim.*, **2**, 25–47 (*June*, 1946) *In Italian.*—A critical exposition of the subject. L. P.

530.145 : 512.86 *see Abstr.* 2748

530.145 : 531.19 = 3 2777

On the thermal dissociation of the vacuum. HOUTERMANS, F. G., AND JENSEN, J. H. D. *Z. Naturforsch.*, **2a**, 146–8 (*March*, 1947) *In German.*—The need of a fundamental length in electron theory is illustrated by the statistical mechanics of the vacuum of the Dirac hole theory, e.g. the number of free electron-pairs increases rapidly with the temp. of the vacuum, and they become closely packed in space when $kT \sim 137mc^2$. G. J. K.

530.145 : 537.533.74 2778

Scattering processes of higher order. HALPERN, O., AND KROLL, N. M. *Phys. Rev.*, **72**, 82 (*July* 1, 1947).—Work in progress confirms the similar analysis by Eliezer [Abstr. 204 (1947)]. W. E. D.

530.145.6 : 537.533.1 2779

Spherical electronic waves? BENHAM, W. E. *Nature, Lond.*, **160**, 160 (*Aug.* 2, 1947).—The waves of Abstr. 3037 (1945) were plane waves, and the treatment is here extended to the physically more probable case of spherical waves. An expression is obtained for the rate of radiation from a moving electron which is pos. for electrons and neg. for positrons, is max. in the direction of motion and is very small unless the beam is brought into close contact with matter.

530.145.6 : 539.11 2780

Stability and spectrum in the wave mechanics of lattices. WINTNER, A. *Phys. Rev.*, **72**, 81–2 (*July* 1, 1947).—The solution of the one-dimensional Schrödinger equation is discussed for the case of a periodic lattice potential. W. E. D.

GENERAL MECHANICS . MECHANICS OF SOLIDS 531

531.18 : 530.12 *see Abstr.* 2767

531.18 : 537.122 : 530.12 *see Abstr.* 2768

531.19 : 530.145 = 3 *see Abstr.* 2777

531.19 : 541.123.2 2781

Statistical mechanics of binary mixtures. MILLER, A. R. *J. Chem. Phys.*, **15**, 513–17 (*July*, 1947).—The possibility of specifying both the enumeration of the complexions of an assembly and the evaluation of its configurational energy in terms of the numbers of closest-neighbour pairs of sites of various kinds, without introducing parameters explicitly to specify the occupation of individual sites, is considered. The formula obtained on such a basis by Alfrey and Mark is examined. It is shown that the assumption made by Alfrey and Mark [Abstr. 2269 (1942)] is equivalent to neglecting the restrictions on the free allocation (amongst the $\frac{1}{2}zN$ pairs available in all) of pairs of different kinds which are inherent in the interconnections of an assembly of interacting particles, and is unjustified. Consequently the quasi-chemical equation is correctly introduced as an *ad hoc* assumption. A.

531.51 : 530.12 *see Abstr.* 2769

531.558 : 518.5 *see Abstr.* 2751

MECHANICAL MEASUREMENTS 531.7

531.719.24 : 535.833 *see Abstr.* 2864

531.761 : 534.321.9 : 534.614 *see Abstr.* 2815

531.788.12 2782

The use of the McLeod gauge with a mixture of gas and vapour. EDE, A. J. *J. Sci. Instrum.*, **24**, 198–9 (*Aug.*, 1947).—A modified McLeod gauge is described which can be used to measure the partial pressures of both components of a mixture of air and water vapour. The air pressure is determined by freezing in a cold trap the vapour from a small sample of the mixture, and the total pressure by connecting the gauge to the system via the same trap. Some limitations of the method are discussed. A.

531.788.13 = 5 2783

Universal vacuum-meter. ROSTAGNI, A. *Ric. Sci.*, **14**, 416–21 (*Oct.–Nov.–Dec.*, 1943) *In Italian.*—Various types of vacuum-meters are discussed. An instrument is described and illustrated, using a suspended Al foil whose deflection opposite a heated Al plate may be gravity-compensated by tilting the tube in which the foil is suspended about a conical connection to the vacuum chamber. The instrument is reliable at pressures from a few torr to 10^{-7} torr (mm Hg). J. A. W.

MECHANICS OF LIQUIDS 532

532.133 : 536.423.15 2784

A relationship between viscosity, density, and vapour pressure of liquids. THOMAS, L. H. *J. Chem. Soc.*, 822–8 (*June*, 1947).—An equation is proposed connecting the fluidity (ϕ) and the density (d) of a liquid with vapour pressure, and a comparison made of $\phi\sqrt{(d)}$ at corresponding pressures. The value of $\phi\sqrt{(d)}$ at the same reduced pressure is approximately a constant for all non-associated non-symmetrical substances. The significance of this constant is discussed. [See Abstr. 543 (1947)]. A.

532.517 : 535.55 2785

The optical investigation of fluid flow. WELLER, R. *J. Appl. Mech.*, **14**, *A*103–7 (*June*, 1947).—The methods of photo-elastic stress analysis can be carried over to the study of the flow of fluids by making use of the double refraction developed in viscous shear. The effect is referred to as the "photoviscous effect." Suitable liquids are tabulated, the method of calibration is described, and qualitative results are shown for a few simple conditions obtained in an experimental liquid tunnel. A.

532.517.4 2786

Decay of vorticity in isotropic turbulence. BATCHELOR, G. K., AND TOWNSEND, A. A. *Proc. Roy. Soc. A*, **190** 534–50 (*Sept.* 9, 1947).

532.517.4 2787

Measurements in the turbulent wake of a cylinder. TOWNSEND, A. A. *Proc. Roy. Soc. A*, **190** 551–61 (*Sept.* 9, 1947).

532.525 : 532.595 = 4 2788

Oscillation of a liquid jet. LITTAYE, G. *J. Phys. Radium* (*Sér.* 8) **7**, 310–12 (*Oct.*, 1946) *In French.*—The transverse oscillations of a liquid jet (water) issuing, with a certain range of velocities, from a small orifice are investigated experimentally. Weber's theory of the oscillations [*Z. angew. Math. u. Mech.*, **11**, 136 (1931)] is not confirmed. No satisfactory theory of the origin of the oscillations, which are produced even when the orifice is most carefully protected from vibration, is available, but it is suggested that both striction of the jet at low velocities and the transverse oscillations observed over a middle range of velocities are associated with the transition from the parabolic distribution of velocities in the jet to a uniform distribution. J. S. G. T.

532.59.08 : 551.465.018.1/.2 : 621.396.944 278[illegible]

Measurement of ocean waves generated by atomic bombs. HOLTER, N. J. *Electronics*, **19**, 94–8 (*May* 1946).—Describes briefly a variety of equipment used: Portable, standard ship-type and buoy-mounted recording echo-sounders; self-contained and shore-connected bottom-mounted wave-pressure recorders; tower and aerial photography; recording television; radio-link wave buoys; max. water-height and water-level recorders. The damaging effects of blast and ionizing radiation and the precautions taken are discussed, together with the forms of instrument timing and the power supplies used. H. G. M. S.

532.593 279[illegible]

The effect of a fixed vertical barrier on surface waves in deep water. URSELL, F. *Proc. Camb. Phil. Soc.*, **43** 374–82 (*July*, 1947).—The 2-dimensional reflection of surface waves from a vertical barrier in deep water is studied theoretically. It can be shown that when the normal velocity is prescribed at each point of an ∞ vertical plane extending from the surface, the motion on each side of the plane is completely determined, apart from a motion consisting of simple standing waves. In the cases considered here the normal velocity is prescribed on a part of the vertical plane and is taken to be unknown elsewhere. From the condition of continuity of the motion above and below the barrier an integral equation for the normal velocity can be derived, which is of a simple type, in the case of deep water. Various extensions of the barrier and positions of its edge are discussed. A.

532.595 : 532.525 = 4 *see Abstr.* 2788

CAPILLARITY 532.6

532.612.4 : 532.7 279[illegible]

Surface tension in liquids. GURNEY, C. *Nature Lond.*, **160**, 166–7 (*Aug.* 2, 1947).—An explanation is offered for the apparent tensile stress existing in the free surface of liquids. Gibbs' "intrinsic potential" μ is recalled, which must have the same value throughout all the component parts of a system in thermodynamic equilibrium; it is a measure of the "escaping tendency" of molecules, and, e.g., is less in solid Pb at room temp. than in liquid Pb, hence any molecules of liquid which might exist would escape into the solid phase at once. Intrinsic potential of a given component may be affected by mechanical stress and equilibrium thereby achieved. The surface molecules of a liquid have a higher μ than the internal, and equilibrium can only be achieved if this is reduced by a tensile stress, which is automatically generated by depopulation of the surface through excessive departure of molecules towards the interior, until the μ's are balanced.

532.613.5 : 536.423.4 *see Abstr.* 2869

532.623 : 539.21 : 548.713 *see Abstr.* 3007

KINETIC THEORY OF LIQUIDS 532.7

532.7 2792

A general kinetic theory of liquids. III. Dynamical properties. BORN, M., AND GREEN, H. S. *Proc. Roy. Soc. A*, **190** 455–73 (*Sept.* 9, 1947).—The theory of liquids [Abstr. 771, 1147 (1947)] is here extended to liquids in motion. The connection between the macroscopic and microscopic properties is revealed by the derivation of a set of generalized hydrodynamical

tions, of which the fundamental equations of hydro-
mics are a special case; the more general equations
ribe the mean motion of clusters of molecules in the
. It is shown that the pressure tensor and energy-flux
or in a fluid consist of two parts, due to the thermal
ion of the molecules and the intermolecular forces
ectively, of which only the first is found in the kinetic
ry of gases, but of which the second is dominant for
liquid state. A method is evolved for the study of
e "normal" non-uniform states which relate to actual
natomic fluids in motion. It becomes apparent, as in
case of equilibrium, that there is a region of tem-
ture and density where analytical singularities arise,
ely associated with the process of condensation.
orous expressions for the coefficients of viscosity and
mal conduction are then derived which apply equally
he liquid and the gas. They consist of two parts due
he thermal motion and molecular forces respectively,
which the first is dominant for the gas, and the second
he liquid. By approximating to the rigorous formula,
expression for the viscosity of liquids is obtained,
nparable with certain other formulae, previously
posed on quasi-empirical grounds, and giving good
eement with experiment. An integro-differential
uation is derived for the determination of the distribu-
n functions relating to the non-uniform state. A full
cussion is given of the simplest case, and the velocity
tribution in non-uniform liquids and gases examined.
A.

2.7 : 532.612.4 *see Abstr.* 2791

2.74 : 534.22.093.3 *see Abstr.* 2802

2.74 : 535.375.5 = 4 *see Abstr.* 2848

2.74 : 541.124 2793

"Structure" in liquids and the relation between the rameters of the Arrhenius equation for reactions in the ndensed phase. WARING, C. E., AND BECHER, P. *Chem. Phys.*, **15**, 488–96 (*July*, 1947).—On the basis the liquid state being quasi-crystalline, a modification the transition state theory leads to a simple equation r the temp.-dependence of the fluidity, which involves characteristic frequency of molecular vibration. The rameters of the fluidity equation are shown to have a near correlation for certain liquids. The quasi-ystalline picture is then extended to a simple collision eory of uni- and bimolecular reactions in solution, and is shown that the known correlation of the parameters the Arrhenius equation arises from the fluidity rrelation. A.

MECHANICS OF GASES 533

33.15 : 533.7 2794

Determination of the self-diffusion coefficient of methane. VINN, E. B., AND NEY, E. P. *Phys. Rev.*, **72**, 77–8 (*July* 1, 1947).—The coefficient, D, was measured by mixing methane enriched with $C^{13}H_4$ with ordinary methane and examining subsequent samples with a mass spectrometer. The result was $\zeta D = 146 \pm 4$ μpoise at 0°C, where ζ is the density. On comparison with the viscosity η of methane this leads to a value of 1·33 for the constant $\varepsilon = \zeta D/\eta$; on the other hand, the variation of viscosity with temp. gives $\varepsilon \simeq 1{\cdot}54$. W. E. D.

33.15 : 539.155.2 = 3 *see Abstr.* 2955

33.15/.16 : 536.23 : 533.7 *see Abstr.* 2796

33.16 : 533.72 = 3 *see Abstr.* 2797

33.2 : 536.711 : 539.16.08 : 536.423.4 *see Abstr.* 2871

33.5 = 5 2795

Protection device for vacuum installations. ROSTAGNI, A. *Riv. Nuovo Cim.*, **2**, 1–3 (*June*, 1946) *In Italian.*—A centrifugal governor is connected to the backing pump, and if rotation stops a trigger is released closing a tap on the vacuum side. A diagram and photograph are shown.

533.6.011 : 523.161 *see Abstr.* 2757

KINETIC THEORY OF GASES 533.7

533.7 : 533.15 *see Abstr.* 2794

533.7 : 533.15/.16 : 536.23 2796

Low temperature transport properties of gases. I. Helium. AMDUR, I. *J. Chem. Phys.*, **15**, 482–7 (*July*, 1947).—Values have been computed for the viscosity, thermal conductivity, and coefficient of self-diffusion of gaseous He for temp. <200°K by application of classical scattering theory within angular regions where diffraction effects are absent. Numerical values of the transport properties are obtained by substitution of the appropriate classical cross-sections into the exact transport property formulae of Chapman and Enskog. In the region 200°–14°K, the average absolute deviations between calculated and experimental values are 1·9% for viscosity and 4·6% for thermal conductivity. Extrapolation of calculated viscosity values to 1·64°K appears to be justified on the basis of agreement with experimental values. Similar extrapolation in the case of thermal conductivity is uncertain because of possible uncertainties in the experimental values between 3·95° and 1·62°K. Values of the self-diffusion coefficient have been calculated between 200° and 5°K. A.

533.72 : 533.16 = 3 2797

The volume viscosity of gases as a gas-kinetical transport phenomenon. KOHLER, M. *Naturwiss.*, **33**, 251–2 (*Oct.* 30, 1946) *In German.*—The volume viscosity μ is defined by $T_{ii} = p - \mu \operatorname{div} \vec{v} - 2\eta(d_{ii} - \frac{1}{3}\operatorname{div} v)$, where the T_{ii} ($i = 1, 2, 3$) are the diagonal elements of the stress tensor, p the pressure, $\vec{v} = (v_1, v_2, v_3)$ the velocity, η the ordinary viscosity and $d_{ii} = \partial v_i/\partial x_i$. The Maxwell relation $\mu = 0$ is true only for a monatomic gas. A polyatomic gas in which the oscillations are not excited and the rotations are fully excited can be treated by representing the molecules as rough spheres. If $\kappa = 4\pi I/MD^2$ is used as an expression for the density distribution in the sphere (I = moment of inertia, m = mass, D = diameter), this model gives:

$$\mu/\eta = (1 + \frac{13}{6}\kappa)/10\kappa > 0{\cdot}336.$$

The volume viscosity causes an increase in the absorption of sound. For $C_p/C_v = 4/3$ this amounts to more than 20% of the contribution due to viscosity and thermal conductivity. This result is in agreement with experiment. H. L.

533.75 : 536.71 : 541.126 2798

An equation of state for gases at extremely high pressures and temperatures from the hydrodynamic theory of detonation. COOK, M. A. *J. Chem. Phys.*, **15**, 518–24 (*July*, 1947).—The hydrodynamic theory of detonation is derived in a convenient form for practical utility by employing the general equation of state $pv = nRT + \alpha(T,v)p$. Two methods of solution of the general equations based on measured detonation velocity are discussed, and evidence is provided that the approximation $\alpha = \alpha(v)$ is valid. All explosives yet investigated show the same α versus v_2 curve, and detonation velocities for a wide range of explosives can be computed from it within experimental error. Data on the detonation

properties of several explosives are presented and correlated with similar data obtained by other investigators. A.

VIBRATIONS . ACOUSTICS 534

534.121.1 : 534.845 = 4 2799

Vibration of a metal panel in a sound field. VOGEL, T. *J. Phys. Radium* (*Sér.* 8) **7**, 193–201 (*July*, 1946) *In French.*—The transparency of a vibrating metal panel (in an ∞ wall) in a uniform sound field is discussed theoretically. An approximate expression for the transparency is deduced at exciting frequencies widely different from the fundamental resonance frequency of the panel. An experimental method of measuring the acoustic transparency of panels of different dimensions is described. The results obtained agree well with the author's theoretical formulae, but disagree notably from the values deduced from Davis's theory, especially for panels of small dimensions. A. B. W.

534.131 2800

On Rayleigh waves in visco-elastic media. SCHOLTE, J. G. *Physica, 's Grav.*, **13**, 245–51 (*May*, 1947).—The Rayleigh movement possible in a visco-elastic medium is investigated theoretically by an examination of the plane wave-systems which can exist in an ∞ and in a semi-∞ body. It appears that the theory of Hardtwig is partly erroneous and that his conception of a Rayleigh wave-system is too narrow. A.

534.213 = 5 2801

On the velocity equation of Rayleigh waves. VALLE, P. E. *Ric. Sci. Ricostruz.*, **15**, 567–8 (*Dec.*, 1945) *In Italian.*—Rayleigh's equation is obtained from the general equation $(u, v, w) = \text{grad } \Psi + \text{curl } (L, M, N)$ when the coefficients to the time derivatives of $\Delta_2\Psi$ and $\Delta_2(L, M, N)$ vanish. J. A. W.

534.22 : 536.712 : 536.48 *see Abstr.* 2876

534.22.093.3 : 532.74 2802

Propagation of ultrasonic waves through liquid mixtures and the dynamics of their molecular interaction. PARSHAD, R. *J. Chem. Phys.*, **15**, 418–19 (*June*, 1947).—The ultrasonic velocity in liquids is used as a measure of the degree of molecular association. Mixtures of alcohol/chloroform, water/glycerine, chloroform/carbon tetrachloride, acetone/water, acetic acid/water and NaCl/water/alcohol were studied. Maxima of velocity occur when an associated liquid is depolymerized by an associated liquid (water/alcohol) or by an unassociated but dipolar and active liquid (water/acetone). M. H. F. W.

534.231.3 : 621.392.51 : 621.3.011.1 2803

Violation of the reciprocity theorem in linear passive electromechanical systems. JEFFERSON, H. *J. Acoust. Soc. Amer.*, **19**, 502 (*May*, 1947).—McMillan's treatment [Abstr. 253 (1947)] is criticized on the grounds of invalid series interconnection of networks. By application of the methods of the author and of Bloch [Abstr. 2835, 1057 B (1945)] the violation is shown not to exist.

534.231.3 : 621.392.51 : 621.3.011.1 2804

Reciprocality in transducers. TRENT, H. M. *J. Acoust. Soc. Amer.*, **19**, 502–3 (*May*, 1947).—It is pointed out that McMillan [Abstr. 253 (1947)] has used only one of two possible electromechanical analogies relating voltage, current, force and velocity. The inverse to his argument is also true, depending on which analogy is used, and the conclusion of non-reciprocality is falsely reached by a simultaneous use of both analogies.

534.232 : 534.321.9 : 621.391.63 = 5 2805

Ultrasonic cell of large area for modulation of light. GIACOMINI, A. *Ric. Sci. Ricostruz.*, **15**, 52–3 (*July*, 1945). *See also Alta Frequenza*, **12**, 409–16 (*Oct.–Nov.–Dec.*, 1943) *In Italian.*—A description of a cell built u of 1×3×0·058 cm quartz plates. The characteristi giving the electro-optical response for ultrasonic modul tion of 5 Mc/s applied to the quartz plates is shown The power fed to the cell is 2·1 W with 100% modulatio J. A. V.

534.232 : 621.392.51 : 621.395.61 280

Measurement of electromotive force of a microphon COOK, R. K. *J. Acoust. Soc. Amer.*, **19**, 503–4 (*Ma* 1947).—The application of the electromechanic generalization of Thévenin's theorem to transducers discussed, in connection with the substitution method measurement (adjustment of e.m.f. source in series wit passive transducer to give output equal to that from given sound pressure). The mechanical impedance of th medium (air) seen by the diaphragm should be 0 durin the passive measurements, and though in practice thi may not be possible, leading to the invalidation of th electromechanical Thévenin theorem, the error is probabl very small (on the basis of measurements with a Weste Electric 640 A microphone).

534.232 : 621.395.623.7 = 5 280

Radiation characteristics of a rigid sphere provided wit an oscillating cap. BORDONI, P. G. *Ric. Sci. Ricostruz* **15**, 54–5 (*July*, 1945) *In Italian.*—The sphere and cap considered the most convenient equivalent circuit to loudspeaker with closed cubical screen. Spherica harmonic analysis of the system leads to the conclusion that the irradiated power remains nearly const. within certain frequency limit, decreasing with higher frequencies and that the acoustic pressure on the axis increases wit frequency, up to twice the initial value. J. A. W.

534.232 : 621.395.623.7 = 5 280

Distortion in loudspeakers. BENUSSI, P. *Tecn. Ital.*, 2 12–16 (*Jan.–Feb.*, 1947) *In Italian.*—The movement o the coil of a loudspeaker is not ∝ the current passin through it. This distortion is partly magnetic and partl mechanical. The latter effect is examined in detail Stationary waves, formed by the vibration of a blade o the surface of a liquid, can be photographed by means o a simple device, and the results have been found usefu when investigating the stationary waves formed in th air in front of a loudspeaker. L. B. F.

534.321.9 280

Ultra sound waves made visible. WILLARD, G. W *Bell Lab. Rec.*, **25**, 194–200 (*May*, 1947).—Some beauti ful photographs of focusing, reflection, diffraction o ultrasonic beams in a liquid are reproduced, obtaine by use of the Debye–Sears effect. P. O

534.321.9 : 531.761 : 534.614 *see Abstr.* 2815

534.321.9 : 534.614 281

A pulse method for the measurement of ultrasoni absorption in liquids: results for water. PINKERTON J. M. M. *Nature, Lond.*, **160**, 128–9 (*July* 26, 1947).— Technique similar to Pellam and Galt [Abstr. 562 (1947) was used (pulses 2–40 μsec duration, at 250 c/s, quart transducer, 1 mW mean power.) Scattering could b distinguished from true absorption, but did not occur Measurements in water between 0° and 60°c at 6 fre quencies (7–66 Mc/s) are reported; (absorption)/(fre quency)² = const. at a given temp. but is ~3× Stokes theoretical figure; the ratio is very constant with respec to temp. except between 0° and 10°c.

534.321.9 : 534.614 *see Abstr.* 2814

534.321.9 : 534.845 281

Ultrasonic absorption from 75 to 280 Mc/sec. RAPUANO R. A. *Phys. Rev.*, **72**, 78–9 (*July* 1, 1947).—Absorptio

measured for a number of liquids by determining the ation in amplitude of a reflected echo with the ance between the reflector and transducer; the latter g an X-cut quartz crystal with a fundamental fre- ncy of 15 Mc/s. Frequencies used are odd harmonics he crystal between 75 and 280 Mc/s. The results are ulated and it is found that the attenuation is propor- al to (frequency)². W. E. D.

.321.9 : 621.391.63 : 534.232 = 5 *see Abstr.* 2805

.44 : 534.755.3 2812

ombination tones. YATES, H. G., AND CATHERALL, R. *ure, Lond.*, **160**, 198 (*Aug.* 9, 1947).—An electronic e analyser with selectivity corresponding to $Q \simeq 100$ ected only traces (<½%) of sum (1 760) and difference 0 c/s) frequencies when fed with superimposed usoidal voltages of 1 025 and 735 c/s frequencies. analyser was not entirely free from distortion which uld give a rectifying effect.

.6 = 4 2813

Acoustic room at the National Centre for the Study of lecommunications. CHAVASSE, P. *C.R .Acad. Sci., ris*, **224**, 1341–3 (*May* 12, 1947) *In French.*—Intensities iform to ±1 db, within a vol. of 1 500 l, for all fre- encies between 200 and 10 000 c/s, can be obtained. tails of the design are given. G. F. H.

4.614 : 534.321.9 2814

Propagation of u.h.f. sound in mercury. RINGO, G. R., TZGERALD, J. W., AND HURDLE, B. G. *Phys. Rev.*, **72**, -8 (*July* 1, 1947).—Measurements were made from 5 to 996 Mc/s using piezo-electric transducers. Neither e velocity nor the frequency-free attenuation coefficient . attenuation coefficient/f^2) varied with the frequency, of the wave. W. E. D.

4.614 : 534.321.9 *see Abstr.* 2810

4.614 : 534.321.9 : 531.761 2815

A time micrometer of high accuracy. NEUMANN, E. A. *oc. Phys. Soc., Lond.*, **59**, 585–90 (*July*, 1947).—The ne of travel and return of a supersonic wave pulse flected from a movable piston is used as the basis for curate measurement of the time interval between two gnals, as presented on a c.r.t. An accuracy of 1 in 000 is obtained, over a range of 5 to 240 μsec. Temp. riation of velocity is avoided by using water at 72·7°C here it has a zero temp. coeff. The velocity at this temp. f 80 Mc/s waves is 1 552·7 m/sec, and the method used obtaining this figure are described.

34.755.3 : 534.44 *see Abstr.* 2812

34.833 = 5 2816

Measurement of acoustic absorption by means of eterminations of phase. SACERDOTE, G. *Alta Frequenza*, **2**, 98–100 (*April*, 1947) *In Italian.*—Using the methods f electrical line theory as in Abstr. 556 (1947) the power bsorbed is calculated from the phase difference of two ressures with relation to a third measured at three oints in a Kundt's tube. A.

34.837 2817

Sound control in airplanes. BERANEK, L. L., AND RUDMOSE, H. W. *J. Acoust. Soc. Amer.*, **19**, 357–64 (*March*, 1947).—Equipment and technique used for noise- neasurement, and the specification of acceptable noise evels for articulate speech, are discussed, a "speech nterference level" being defined. L.f. noise is chiefly due to propellers and h.f. noise to vortices and turbulent air-flow. Data for constructing charts to give noise in erms of engine power, propeller speed and clearance rom the fuselage, is given. Determination from classical formulae of sound levels in cabins is also considered. G. F. H.

534.843 2818

Mean free path of sound in an auditorium. BATE, A. E., AND PILLOW, M. E. *Proc. Phys. Soc., Lond.*, **59**, 535–41 (*July*, 1947).—A brief review of the subject is followed by proofs that the mean free path of sound in an enclosure = 4(volume/surface area) for rectangular, spherical and cylindrical rooms of any dimensions. A.

534.845 : 534.121.1 = 4 *see Abstr.* 2799

534.845 : 534.321.9 *see Abstr.* 2811

534.85 2819

Measurement of mechanical compliance and damping of phonograph pick-ups. BAUER, B. B. *J. Acoust. Soc. Amer.*, **19**, 319–21 (*March*, 1947).—A method and apparatus are described for dynamic measurement of lateral compliance and mechanical resistance of phonograph pick-ups. The equipment is easily modified to measure vertical compliance and resistance. The method is adaptable to measurements of mechanical impedance of certain types of structures and damping materials. A. B. W.

OPTICS . RADIATION . SPECTRA 535

535.1 2820

The convection of light under various circumstances with special reference to Zeeman's experiments. ZERNIKE, F. *Physica, 's Grav.*, **13**, 279–88 (*May*, 1947).

535.215.1 : 537.533 = 4 *see Abstr.* 2911

535.242.43 : 621.317.757 2821

The modulation of a beam of light by a sector wheel and a method of testing the waveform. DIGHTON, D. T. R., ROSS, H. M., AND SHUFFREY, A. L. *J. Sci. Instrum.*, **24**, 202–5 (*Aug.*, 1947).—An investigation was made of the form of aperture required to produce a desired waveform, using a photocell, amplifier containing a differentiating stage and a c.r.o. The differentiating stage has the effect of accentuating the harmonic frequencies, and increasing the accuracy of their assessment by graphical means. The harmonic content of a sinusoidally modulated light beam could be made quite low (<5%).

535.243 : 535.372 2822

The photoelectric measurement of fluorescence spectra. BURDETT, R. A., AND JONES, L. C., JR. *J. Opt. Soc. Amer.*, **37**, 554–7 (*July*, 1947).—An attachment is described which makes possible the measurement of fluorescence spectra with the Beckman Spectrophotometer. The fluorescence spectra of a few aromatic hydrocarbons are presented. A.

535.243 : 535.39 2823

A photoelectric spectrophotometer for measurements of reflexion and transmission of visible light. BANNON, J. *J. Sci. Instrum.*, **24**, 205–7 (*Aug.*, 1947).

535.243–15 : 621.317.794 2824

Automatic ratio recorder as applied to infra-red spectroscopy. WILD, R. F. *Rev. Sci. Instrum.*, **18**, 436–42 (*June*, 1947).—[Abstr. 2475 B (1947)].

535.247.4 : 535.434.08 *see Abstr.* 2857

535.247.4 : 621.383.2 2825

Multiplier photo-tube characteristics: application to low light levels. ENGSTROM, R. W. *J. Opt. Soc. Amer.*, **37**, 420–31 (*June*, 1947).—[Abstr. 2505 B (1947)].

535.312 = 4 2826

Formulae relating to a thin transparent sheet between two transparent media in the case of total reflection. ABELÈS, F. *C.R. Acad. Sci., Paris*, **224**, 1494–6 (*May* 28, 1947) *In French.*—Formulae giving the coefficients of reflection and transmission of such an arrangement,

together with the phase change associated with reflection. H. H. HOP.

535.317.25 : 535.8 : 535.42 *see Abstr.* 2854

535.317.9 2827

On the determination of aspheric profiles. WOLF, E., AND PREDDY, W. S. *Proc. Phys. Soc., Lond.*, **59**, 704–11 (*July*, 1947).—Exact parametric equations are deduced for the profiles of plano-aspheric lenses designed to produce axial stigmatism in a given axially symmetric pencil of rays. These formulae take an agreeably simple form in the special case where the point of stigmatism is at ∞. As an application, parametric equations are deduced for the corrector plate of the Schmidt camera. A.

535.33.072 : 551.508.79 2828

Use of the cathode ray oscillograph for studying the near infra-red solar spectrum. MOMIN, A. U. *Nature, Lond.*, **160**, 130–1 (*July* 26, 1947).—A slit backed by a Cs_2O photo-electric cell is scanned at 50 c/s across the spectrum, and the resulting current amplified and presented on the c.r.o. The apparatus is used for the rapid estimation of water vapour in the atmosphere.

535.338 2829

On the spectra of the rare earth elements. KLINKENBERG, P. F. A. *Physica, 's Grav.*, **13**, 1–16 (*March*, 1947).—Calculations based on well-known relations which have been derived from the vector model show a considerable difference between the multiplet separations in the configurations $4f^x6s^2$ and $4f^{x-1}5d6s^2$ of some neutral rare earth spectra. They allow a conclusion on the character of the ground state to be drawn in some cases from only a few intervals found between most prominent lines. Applied to the case of Tb I the ground configuration of this spectrum turns out to be $4f^85d6s^2$. A few low levels are given. The calculations are extended to the ground terms of Tb II $4f^85d6s^9H$ and ^7H and their relative positions are estimated. Empirical regularities can be interpreted in accordance with the results on Tb I. Levels of both ^9H and ^7H are found. A.

535.338 = 4 2830

Continuous spectra of condensed discharges through gases at low pressure for relatively feeble current-densities. ROMAND, J., AND VODAR, B. *C.R. Acad. Sci., Paris*, **224**, 1634–6 (*June* 9, 1947) *In French.*—Continuous spectra are produced by condensed discharges through capillaries of various dimensions. In some cases, but not all, the spectrum is independent of pressure and nature of the gas. The results of these and other experiments on sparks and discharges are discussed. Variations are probably due to change from a spectrum produced by interaction of ions with electrons to one of molecular origin. A. G. G.

535.338.3 : 538.615 2831

The spectrum and Zeeman effect of uranium. Preliminary analysis. SCHUURMANS, P., VAN DEN BOSCH, J. C., AND DIJKWEL, N. *Physica, s' Grav.*, **13**, 117–40 (*March*, 1947).—New wavelength measurements and Zeeman effect data are reported which make possible the classification of several strong lines. In U II two groups of terms could be established, between which no combinations have been found up till now. Group *A* contains even terms, arising from the electron configuration f^4s (with $I_{7/2}$ lying lowest) and from f^4d. Group *B* contains odd terms, arising from f^3s^2 (with $^4I_{9/2}$ lying lowest), from f^3ds and from f^3d^2. In U I only one group of terms was found. This group contains odd terms, arising from f^3ds^2 (with $^5L_6$ lying lowest) and from f^3d^2s. A.

535.338.4 2832

Emission bands of the PO molecule. RAMANADHAM, R., RAMACHANDRA RAO, G. V. S., AND RAMASASTRY, C *Indian J. Phys.*, **29**, 161–6 (*Oct.*, 1946).—Characteristi bands in the region λ2600 and λ3300, ascribed to the P molecule, are found to be strongly emitted in a wid open heavy current arc between graphite poles containin P_2O_5. The bands at λ3300, which are not yet analysed are partly red and violet degraded. Several attempts t include all the heads into one system having failed, th red-degraded bands are analysed into one vibrationa system and the violet-degraded bands into anothe system, suggested to be due respectively to the electroni transitions $^2\Sigma - {}^2\Pi$ and $^2\Pi - {}^2\Pi$ with a common lowe $^2\Pi$ state. A

535.338.4 283

Silicon flame bands. DOWNIE, A. R., AND BARROW R. F. *Nature, Lond.*, **160**, 198 (*Aug.* 9, 1947).—Provis ional vibrational analysis of bands observed in H flame charged with $SiCl_4$ gave $\omega'' \sim 750$, $\omega' \sim 1\,050$ $\nu_e \sim 19\,000\ cm^{-1}$ for the strongest head at 5 240 Å The emitter may be Si_2.

535.338.4 = 4 283

Band systems of the neutral nitrogen molecule. HERMAN R., AND GAYDON, A. G. *J. Phys. Radium* (*Sér.* 8) 7 121–3 (*April*, 1946) *In French.*—Independent observation by the two authors on bands of N_2 are compared. Se Abstr. 1853 (1946). A. G. G

535.338.4 : 525.75 = 4 *see Abstr.* 2764

535.338.4 : 535.343.4 283

Ultra-violet bands of Na_2. SINHA, S. P. *Proc. Phys Soc., Lond.*, **59**, 610–21 (*July*, 1947).—The bands hav been studied in absorption and emission; in absorption from 3 640 to 2 500 Å by varying the conditions of temp and pressure. They are considered to belong to different systems, of which, however, only 3 are wel developed. The classification of the other 4 system is tentative. It has been shown that the bands measure by Walter and Barratt [Abstr. 2711 (1928)], analyse into 5 different systems by Weizel and Kulp [Abstr 3129 (1930)], may really be considered to belong to systems only, corresponding to systems 1 and 3 of the present investigation, which are the most intensely developed ones. The emission bands are weakly de veloped and have been observed only in the regions 3 370–3 180 Å and 3 070–2 960 Å. These correspond t the strong bands of systems 1 and 3 in absorption. A

535.34 : 535.43 : 537.531 *see Abstr.* 2908

535.342 : 539.11 : 536.212 : 538.224 : 537.311.33 *see Abstr.* 2894

535.343.1 : 523.87 283

Relative *gf*-values for lines of *V* I. KING, R. B *Astrophys. J.*, **105**, 376–89 (*May*, 1947).—The relative *gf*-values for 471 lines in 100 multiplets in the spectrum of *V* I have been measured in electric-furnace absorption spectra. The lines are in the region λλ3043–6812, which includes most of the lines of astrophysical importance A comparison of the results with theoretical multiplet and supermultiplet strengths for LS coupling shows that about 55% of the multiplets exhibit normal line strengths but that in the supermultiplets the agreement with theory is relatively poor. A

535.343.4 283

Absorption bands of Li_2, Na_2, K_2 and NaK. PEARSE R. W. B., AND SINHA, S. P. *Nature, Lond.*, **160**, 159 (*Aug.* 2, 1947).

535.343.4 : 535.338.4 *see Abstr.* 2835

535.343.4 : 535.375.5 : 541.57 : 539.132 *see Abstr.* 2946

343.4–14 2838
nomalous values of certain of the fine structure lines ne ammonia microwave spectrum. NIELSEN, H. H., DENNISON, D. M. *Phys. Rev.*, **72**, 86–7 (*July* 1,).—A qualitative theoretical explanation is put ard for the fact that transitions between levels where 3 and J = an odd integer are displaced to the long elength side, and to the short wavelength side when an even integer. W. E. D.

343.4–14 : 537.228.5 2839
rst-order Stark effect in the microwave spectrum of yl alcohol. DAILEY, B. P. *Phys. Rev.*, **72**, 84–5 v 1, 1947).—Twenty-four lines have been observed the Stark effect has been investigated by modulating absorption with a square wave. [See Abstr. 1814 7)]. The results are tabulated. The Stark effect ted the lines into two groups: one gave a symmetrical the other an unsymmetrical Stark pattern. A dis- ion of the origin of the absorption lines is given. W. E. D.

37 2840
uenching and depolarization of mercury resonance ation by nitrogen and oxygen. OLSEN, L. O., AND R, G. P. *Phys. Rev.*, **72**, 115–17 (*July* 15, 1947).— se effects, in the presence of a weak magnetic field, studied proportional to gas pressure. The pro- ionality constants for each gas are determined. ults of tests on two samples of each gas are given, generally good agreement between separate tests. nching and depolarizing cross-sections are computed the finally selected constants. The measurements considered indicate that adiabatic depolarization, a nomenon tentatively postulated in the theory, is not ent in the case of N and O. [See Abstr. 438 (1942)]. A.

37 : 621.327.43 2841
ew ultraviolet phosphors. FROELICH, H. C. *Trans. trochem. Soc.*, **91** (*Prepr. No.* 11) 23 *pp.* (1947).— er u.v. phosphors are reviewed and 3 newly developed phosphate phosphors are discussed in detail. Com- tion and method of preparation of a Ce^{3+} activated sphor are outlined, and an analysis of its structure is ented. The brightest phosphors contain about 10% ctivator and are of γ tri-orthophosphate structure. use of Tl-activated Ca phosphate in fluorescent sun, ps is pointed out, and methods of measuring and raising u.v. phosphors are discussed. A.

37 : 621.327.43 2842
arium silicate phosphors. BUTLER, K. H. *Trans. trochem. Soc.*, **91** (*Prepr. No.* 27) 13 *pp.* (1947).—A phosphor system, composed of Ba silicates, Pb- ated, is described. Phosphors in this system are ted by 2 537 Å radiation with emission of blue and -green light. The effect of composition on the colour mission is discussed, spectral energy distribution es and X-ray data being presented. The output of e phosphors is comparable with that of tungstates; can be used to make white and daylight fluorescent ps of high efficiency as well as blue lamps in more rated colours than can be obtained with tungstates. A.

37.08 2843
combination phosphorometer and spectroradiometer luminescent materials. HARDY, A. E. *Trans. trochem. Soc.*, **91** (*Prepr. No.* 8) 20 *pp.* (1947).—The ument can determine: spectral energy distribution; tive peak energy and light output; build-up and decay luorescence and phosphorescence under continuous iscontinuous excitation; flicker; secondary emission; stability to electron bombardment and sunlight; photo- conductivity; infra-red quench and stimulation effects; and absorption spectra. The equipment consists of: a demountable vacuum chamber equipped with an electron gun; a motor-driven spectroscope with a photo- multiplier at the exit slit; the multiplier; a 12-in c.r.o. and amplifiers; and a light source with a solenoid- operated shutter. A.

535.371.07 2844
The light emission from fluorescent screens irradiated by X-rays. KLASENS, H. A. *Philips Res. Rep.*, **2**, 68–78 (*Feb.*, 1947).—Applying Schuster's theory as extended by Hamaker [Abstr. 2867 (1947)] for the scattering and absorption of light, general equations are deduced for the amount of light emitted. Some commercial screens were examined to measure the "absorption" coefficient of the fluorescent light. Several means to increase the brightness of a screen are discussed. A.

535.372 2845
Fluorescence of cadmium borates activated by manganese. BOTDEN, T. P. J., AND KRÖGER, F. A. *Physica, 's Grav.*, **13**, 216–24 (*May*, 1947).—In the system $CdO \cdot B_2O_3$ four compounds exist, which each show fluorescence when activated by Mn. $Cd_2B_2O_5$–Mn is excited by $\lambda < 3\,200$ Å and cathode rays and then shows an orange luminescence, whereas CdB_2O_4, $Cd_2B_6O_{11}$ and $Cd_3B_2O_6$ show a green cathodo-luminescence only. The luminescence of the $Cd_2B_2O_5$–$Mn_2B_2O_5$ phase has been studied quantitatively both as a function of the manganese content, the exciting radiation and the temperature. It is shown that an ultraviolet emission, appearing at low temp. in some of the products, cannot be responsible for the anomalous decrease of the red luminescence towards low temp. A.

535.372 2846
Fluorescence of silicate phosphors. BUTLER, K. H. *J. Opt. Soc. Amer.*, 37, 566–71 (*July*, 1947).—An hypothesis is proposed connecting the absorption and emission bands with the energy levels of the activator ions. It is shown that the energy levels of the ions must be radically changed as the ions enter the lattice of the solid. Detailed excitation and radiation attributions are made for Mn-activated Zn silicate, and Pb-activated alkaline earth phosphors; the results of Be additions and Mn-activated alkaline earth phosphors are briefly discussed. A.

535.372 : 535.243 *see Abstr.* 2822

535.375.5 = 4 2847
Preparation and Raman spectra of thiophosphoryl halides. DELWAULLE, M.-L., AND FRANÇOIS, F. *C.R. Acad. Sci., Paris*, **224**, 1422–3 (*May* 19, 1947) *In French.*—Methods of chemical preparation of the compounds $PSCl_3$, $PSCl_2Br$, $PSClBr_2$ and $PSBr_3$ are given, their Raman frequencies and polarizations are determined and the results are discussed in relation to molecular symmetries. L. A. W.

535.375.5 : 532.74 = 4 2848
State of nitric acid in solution. Evidence for a Raman frequency of $HNO_3 \cdot H_2O$. CHÉDIN, J., AND FÉNÉANT, S. *C.R. Acad. Sci., Paris*, **224**, 1424–5 (*May* 19, 1947) *In French.*—Microphotometer curves for the Raman spectra of aqueous solutions (100 to 75% HNO_3 by weight) indicate that the Raman frequency 608 cm^{-1}, characteristic of the HNO_3 molecule, disappears as the acid concentration is reduced, and is replaced by a new frequency 637 cm^{-1}, which is attributed to the species $HNO_3 \cdot H_2O$. L. A. W.

535.375.5 : 541.57 : 535.343.4 : 539.132 *see Abstr.* 2946

535.376 : 778.33 = 4 2849

Establishment of the fugitive illumination of certain sulphides. Application to electrophotoradiography. DESTRIAU, G., AND MATTLER, J. *J. Phys. Radium* (*Sér.* 8) **7**, 259–65 (*Sept.*, 1946) *In French.*—Phosphors irradiated by X-rays release their stored energy as a sudden burst of light when subjected to an a.c. field of the order of 30 000 V/cm. The total amount of light produced shows a max. at a certain dosage of X-ray energy. This optimum dose increases with increasing X-ray voltage, but the max. light output is not greatly affected by the conditions of irradiation. Theoretical aspects are considered. A new type of radiograph may be made with a luminescent screen, taking advantage of the max. on the dose *v.* light output curve to alter the usual contrasts. S. T. H.

535.39 2850

The reflexion factor of glass. HOLMES, J. G. *Trans. Illum. Engng Soc., Lond.*, **12** (*No.* 5) 108–14 (1947).—Figures are given for the reflection factor of air-glass surfaces for directed light at several angles of incidence and for diffused light, making allowance for the effects of polarization and multiple reflection in a glass sheet. The definition of transmittance and the effects of a prismatic surface are discussed. A.

535.39 2851

The reflectivity and transmissivity of multiple thin coatings. WEINSTEIN, W. *J. Opt. Soc. Amer.*, **37**, 576–81 (*July*, 1947).—General expressions for the transmissivity and reflectivity of multi-layer coatings of any number of components, for light polarized in any way and incident at any angle, are derived. A.

535.39 : 535.243 *see Abstr.* 2823

535.39 : 539.23 = 4 2852

Changes in very thin silver films. PERROT, M. *C.R. Acad. Sci., Paris*, **224**, 1629–31 (*June* 9, 1947) *In French.*—The spontaneous changes in the reflection factors of thin Ag films, of thicknesses 0–11 mμ, deposited by evaporation on wedge-shaped glass plates, were examined. Light of wavelength 5 461 Å was used. The films were produced and maintained in a vacuum of $<10^{-5}$ mm Hg. For a given film thickness, the reflection factor for the metal/glass interface varies with time, tending towards a limiting value R_f' which is more rapidly attained the thinner the film. Although admission of air to the apparatus raises R_f' it returns to the lower value on re-evacuation. S. W.

535.393 : 539.23 = 4 2853

Study of certain optical properties of very thin films of chromium. PERROT, M. *Ann. Phys., Paris*, **19**, 150–207 (*April–June*, 1944) *In French.*—The apparatus and method of preparation, both by cathodic sputtering from a cathode consisting of electrolytically deposited Cr on Al, and by thermal evaporation, of very thin Cr films on a transparent support are described. The sputtered films, which are very adherent, transparent and non-conducting, probably consist of Cr_2O_3. The evaporated films which are slightly less adherent, conducting and grey by transmission, probably consist of almost pure Cr. The film thicknesses, 0 to $\sim$ 170 mμ, were deduced from microbalance weighings. The reflection factors (R, R') for the air/metal and metal/glass interfaces and the transmission factor (T) for films deposited on slightly prismatic glass supports were measured, using a photo-electric cell, for various film thicknesses. Light of 4 different wavelengths produced by a Hg arc was used. For sputtered films, R, R' and T have well defined maxima and minima; T is high and the maximum values of R and R' are 20% at $\sim$ 60 mμ. Several useful optical applications of such films are suggested. For evaporated films R' has a min (<1%) which occurs at $\sim$ the same thickness for all th wavelengths. The max. value of R slightly exceeds 50° in the visible, and T decreases steadily with increasin film thickness varying little with wavelength. For th measurement of the phase changes which the light wav undergoes at the metal interfaces, the films were deposite on one of the plates of a Fabry–Perot etalon or on a glas or quartz plate with parallel plane faces, and the dia meters of the rings examined. The variation of the phas changes as a function of film thickness shows that th optical constants of the films are quite different fro those of bulk Cr. A section of the paper is devoted to theoretical discussion, along classical lines, of the optic properties of thin films, and a simple graphical metho for the rapid determination of the variation of th reflection factors with film thickness is included. S. V

535.42 : 535.317.25 : 535.8 285

Theoretical resolution angles for point and line te objects in the presence of a luminous background. COL MAN, H. S., AND COLEMAN, M. F. *J. Opt. Soc. Amer* **37**, 572–6 (*July*, 1947).—The diffraction pattern of th test object and the image of the background are supe imposed, and the apparent contrast of the image of th test object at the entrance pupil of an optical syste calculated for various angular magnitudes. The relatio has been found useful in studying the resolving power optical systems.

535.42 : 537.531 = 4 *see Abstr.* 2909

535.43 : 535.34 : 537.531 *see Abstr.* 2908

535.43 : 536.24 : 536.33 *see Abstr.* 2867

535.434 : 539.215.4 28

The determination of particle size by light scatterin BARDWELL, J., AND SIVERTZ, C. *Canad. J. Res. B*, 2 255–65 (*May*, 1947).—A critical study has been made the various observations necessary for the determinati of the size of small dielectric particles by the Deby Einstein equation, which can take the form: Mass particle $= \frac{3}{32\pi^3}\frac{\lambda^4}{\mu_0^2}\left(\frac{d\tau}{dc}\right)_{c=0}\Big/\left(\frac{d\mu}{dc}\right)^2$. The turbidi measurements were made with a Beckman spectrophot meter and those of refractive index with a Zeiss dippi refractometer. This article deals especially with t determination of the turbidity and refractive ind gradients. The method was applied to the determinati of latex particle size and gave results in good agreeme with independent methods.

535.434 : 539.215.4 28

The determination of the particle size of monodisper systems by the scattering of light. JOHNSON, I., AND MER, V. K. *J. Amer. Chem. Soc.*, **69**, 1184–92 (*M* 1947).—The higher order Tyndall spectra in the visi light scattered by S/sols have been examined. The ord increase in number from 0–9 as the particle radii crease, and have been measured as a function of ti after mixing. The behaviour of the spectra can be plained on the basis of the general electromagn theory of the scattering of light, developed by Mie. comparing the observed and theoretically calcula positions of the orders, the radii of the dispersed partic may be calculated, assuming a value for n of the partic These results have been compared with those obtai by studying the rate of deposition of the particles, a good agreement is found. Studies of the magnitude the ratio of intensity of red to green scattered light fr synthetic mixtures of sols have shown that a quantitat measure of the monodispersity of a sol can be obtai by this method. W. R.

34.08 : 535.247.4 2857

nsitive photoelectric photometer. GUCKER, F. T., *Electronics*, **20**, 106–10 (*July*, 1947).—Designed for atory tests on smoke filters, the equipment can be ted to many industrial problems. The amount of scattered by smoke is picked up at right angles to nain beam and measured by a phototube and d.c. ifier. A.

14.2–15 2858

proved infra-red polarizer. PFUND, A. H. *J. Opt. Amer.*, **37**, 558–9 (*July*, 1947).—The original Se rizer has been found to suffer from two defects: (1) degree of polarization is not sufficiently high, and he necessary dimensions become unwieldy. Both cts are overcome by resorting to two reflections from llel Se mirrors. The efficacy of this procedure is ed by a study of the dichroism of beryl. A discussion e mirrors produced by vacuum distillation follows. A.

55 : 532.517 *see Abstr.* 2785

65 : 666 2859

olorimetry in the glass industry. HOLMES, J. G. *Phys. Soc., Lond.*, **59**, 592–610 (*July*, 1947).

653.4 2860

colorimeter with six matching stimuli. DONALDSON, *Proc. Phys. Soc., Lond.*, **59**, 554–60 (*July*, 1947).—instrument is a modification of the ordinary tri-omatic colorimeter by the addition of an orange, ow-green and blue-green. The spectral energy ribution of the colour being measured is first approxi-ely matched by means of a mixture of all six colours re the final colour match is made by varying three ee colours only. This eliminates to a large extent the onal error of the observer, and allows a large field e used with a resultant gain in sensitivity. A.

.8 : 535.317.25 : 535.42 *see Abstr.* 2854

.82 = 4 2861

new type of objective for the photo-microscope. TRY, G.-A., BILLARD, P.-L. *C.R. Acad. Sci., Paris*, , 1496–8 (*May* 28, 1947) *In French.*—The essential ent comprises two single components of the same s separated by an air-space, the thickness of this er being adjusted to control the chromatic variation spherical aberration. Chromatic correction is other-e ignored, the objectives being intended for use with t of monochromatic sources. The size of useful field ncreased three times. An example of $f = 10{\cdot}4$ mm, $A. = 0{\cdot}35$ is described having a magnification ×24. is claimed that by using quartz or LiF it would be ssible to design objectives giving monochromatic rection in the range 5 500–3 000 Å. H. H. HOP.

5.822 = 4 2862

mage of a small transparent rectangular object by the thod of phase contrast. FRANÇON, M. *Rev. Opt. iéor. Instrum.*) **25**, 257–66 (*Nov.–Dec.*, 1946) *In French.* A mathematical discussion of the image production in case of a small, perfectly transparent, rectangular ject whose refractive index and optical density differ ly very slightly from those of the surrounding medium. e analysis is linked to the work done by Zernike, Lyot d Duffieux. [See Abstr. 460, 3113 and 2542 (1946)]. A. H.

5.822 = 4 2863

The control of amplitude in phase-contrast microscopy. YLOR, E. W. *Proc. Roy. Soc. A*, **190**, 422–5 (*Aug.* 12, 47).—Light passing through the phase-retarding nulus of the Zernicke disc also passes through an nulus of optically active material, which is arranged to tate the plane of polarization 45°. Light passing through the rest of the aperture is similarly rotated 45°, but in the opposite sense. Using plane-polarized illumination and observing the final image through an analyser permits (by simple rotation of the analyser) one to vary the relative amplitudes of the direct and diffracted beams. H. H. HOP.

535.833 : 531.719.24 2864

Compensation of flexure in range finders and sighting instruments. MOFFITT, G. W. *J. Opt. Soc. Amer.*, **37**, 582–5 (*July*, 1947).—Using a suitably spaced combination of anterior negative lens and posterior positive lens instead of telescope objectives, it is possible to provide complete compensation for flexure. Some sample combinations are indicated.

HEAT 536

536.2 = 4 2865

Do heat motions in matter amplify perturbations? VERNOTTE, P. *C.R. Acad. Sci., Paris*, **224**, 1486–8 (*May* 28, 1947) *In French.*—In precise experiments performed on a bronze disc in 1926, Δ, the temp. difference between two parallel planes distance L apart, was observed to be subject to perturbations, when q, the heat flux maintained through the metal, was not perfectly constant. By considering an arrangement in which the maxima of the fluctuations (generally short) of both q and Δ are recorded by the same sensitive galvanometer, it is shown theoretically that the observed relatively large perturbations in Δ can be explained, only in part, by the heat motions and the galvanometer inertia. S. W.

536.2 = 4 2866

Contribution to the mathematical study of the wall problem. PARODI, H. *J. Phys. Radium* (*Sér.* 8) **7**, 287–92 (*Oct.*, 1946) *In French.*—The heat equations $\Phi+\lambda\partial\theta/\partial x=0$ and $\partial\Phi/\partial x+\gamma\partial\theta/\partial t=0$ where θ is the temp., Φ the heat flux, t the time and x the distance from the median plane, are solved, for the cases usual in industrial practice, by a double series expansion. S. W.

536.21 : 538.639 : 537.312.8 *see Abstr.* 2901

536.212 : 538.224 : 535.342 : 539.11 : 537.311.33 *see Abstr.* 2894

536.22 : 536.48 *see Abstr.* 2874–5

536.22 : 536.48 = 4 *see Abstr.* 2873

536.23 : 533.15/.16 : 533.7 *see Abstr.* 2796

536.24 : 535.43 : 536.33 *see Abstr.* 2867

536.33 : 536.24 : 535.43 2867

Radiation and heat conduction in light-scattering material. HAMAKER, H. C. *Philips Res. Rep.*, **2**, 55–67 (*Feb.*); 103–25 (*April*, 1947).—On the basis of a set of simultaneous differential equations originally due to Schuster the transmission and reflection of light in light-scattering layers is discussed. Formulae developed by Kubelka and Munk [Abstr. 1179 (1932)] are recapitulated and extended to describe the luminescence of fluorescent screens excited by X-rays or electron bombardment. Schuster's equations are then extended to include temp. radiation and heat conduction, and certain general features of the solution are discussed. In particular an expression is deduced for the energy transport due to radiation. The equations are then applied to practical problems. The boundary conditions at the surface of a thick layer are investigated. Near the surface the temp. is no longer a linear function of the distance from the surface. Formulae for the deviation from linearity are deduced and the order of magnitude is indicated. On the basis of these theories earlier work on the thermal conductivity of oxide cathodes is shown to be unreliable. A.

536.42 : 536.631.08 *see Abstr.* 2881

536.42 : 551.574 2868

Sublimation in outdoor air. CWILONG, B. M. *Nature, Lond.*, **160**, 198 (*Aug.* 9, 1947).—Sublimation threshold temps. for air samples taken on the Jungfraujoch (11 680 ft) were the same ($-41{\cdot}2 \pm 0{\cdot}05$°c) as for clean air at sea level (Oxford) except for two days when they were intermediate between this figure and that for Oxford outdoor air [see Abstr. 2273 (1945)]. [The previous communication gave −35°c as the threshold for ice formation in clean air.]

536.423.15 : 532.133 *see Abstr.* 2784

536.423.4 : 532.613.5 2869

Pressure coefficient of surface tension and the expansion ratio of high pressure cloud chambers. JOHNSON, T. H. *Phys. Rev.*, **72**, 86 (*July* 1, 1947).—Applying Kelvin's theory of charged droplets to the formation of tracks in high pressure expansion chambers, it is shown that in order to account for the observed expansion ratios the surface tension of *n*-propyl alcohol must vary from 27·2 dynes/cm at 1·5 atm. to 18·2 at 110 atm. when submitted to pressure by inert gases. W. E. D.

536.423.4 : 536.711 : 539.16.08 2870

The threshold expansion ratio of water vapour. VAN HEERDEN, C. *Physica, 's Grav.*, **13**, 41–6 (*March*, 1947).—Applying an expansion to a fixed pressure, the ratio was determined to be $0{\cdot}741 \pm 0{\cdot}001$ for condensation on ions, and $0{\cdot}716 \pm 0{\cdot}002$ for spontaneous condensation. Previous figures obtained with expansion to fixed volume are too high, because of departures from Poisson's adiabatic relations. A.

536.423.4 : 536.711 : 539.16.08 : 533.2 2871

An investigation of the Wilson chamber. MILATZ, J. M. W., AND VAN HEERDEN, C. *Physica, 's Grav.*, **13**, 21–32 (*March*, 1947).—Temperature and pressure were measured in a "dry" Wilson chamber during and after the expansion, using a rapid resistance thermometer and membrane manometer. The time of sensitivity was calculated from the results and found in accordance with the time of sensitivity directly measured in a "wet" chamber. The deviations from Poisson's law were investigated for an expansion to a fixed volume and to a fixed pressure. The time of sensitivity for the last expansion method proved to be 2× the first. A.

536.44 = 4 2872

Determination of the connection between the pressure and the corresponding temperature of ebullition. MILOSAVLIÉVITCH, D. *C.R. Acad. Sci., Paris*, **224**, 1345–6 (*May* 12, 1947) *In French.*—The Clapeyron–Clausius equation is written in the form $d(\log_e p/T) = (y/T)dT$, and an expression is sought for y in order that the equation may be integrated. It was found that y could be represented by $y = b - m(\log_e x - x)$ where b and m are constants for a given substance and $x = pT_k/p_kT$. p_k is the critical pressure and T_k the absolute temp. of the triple point. Substitution in the original equation yields a first order differential equation with separable variables, T and x. The equation is directly integrable if x is negligible compared with $\log_e x$. F. E. H.

536.48 : 536.22 = 4 2873

Measurements on the thermal conductivity and the thermomechanical effect of liquid helium II. KEESOM, W. H., AND DUYCKAERTS, G. *Commun. K. Onnes Lab. Leiden* (*No.* 271*c*). *Physica, 's Grav.*, **13**, 153–80 (*May*, 1947) *In French.*—The heat conductivity and the fountain effect of liquid He II were measured between 1·2°K and the λ-point, in very narrow capillaries ranging from 1 μ to 100 μ. It was found that in very narrow capillaries, the heat transport is proportional to the temperatur gradient. The fountain effect is also proportional to th heat transport, for a given temp. For a given temp gradient, the heat conductivity decreases with the diamete of the capillary; the rate of decrease is greatest betwee 19 μ and 9·3 μ. A

536.48 : 536.22 287

New measurements on the fountain effect and the hea conductivity of liquid helium II. MELLINK, J. H. *Com mun. K. Onnes Lab. Leiden* (*No.* 272*a*). *Physica, 's Grav.* **13**, 180–96 (*May*, 1947).—The measurements of Abstr 2873 (1947) have been continued with slits of 10·5 an 5 μ. The fountain effect $f \propto$ the heat current I at a temps. At low temps. both I and $f \propto$ temp. differenc ΔT; at slightly higher temps. this proportionality exist only for small values of ΔT. The heat current at constant $\Delta T \propto \sim T^{13}$ at temps. $< 1{\cdot}8$°K. In all case of proportionality between fountain effect and ΔT th experimental values of f agree with the theoretical one according to London's formula [Abstr. 3381 (1939) At 5 μ the experimental values seem to exceed th theoretical ones by a few percent for low temp.

536.48 : 536.22 287

The thermomechanical effects in liquid helium I MEYER, L., AND MELLINK, J. H. *Commun. K. Onn Lab. Leiden* (*No.* 272*b*). *Physica, 's Grav.*, **13**, 197–21 (*May*, 1947).—Continuation [Abstr. 2874 (1947)] wit slits of a width below 1 μ. Below a certain width of th slit the fountain effect reaches a limiting value $\propto$ temp difference and rising as a monotonous function of th temp. up to the λ-point. In these slits the heat flow i He II is still $10^5\times >$ in He I under the same condition the temp.-dependence is similar to the fountain effec The critical velocities for frictionless flow through thes slits are practically the same as found for the film betwee He gas and a wall. If He II enters a slit it gives off a amount of heat $T.S$ (T = temperature, S = entropy on leaving a slit it absorbs this amount of heat. If thes transitions occur at velocities higher than the critical th first value increases, whereas the latter decreases cor siderably. The discrepancies between experimental resul and theoretical expectations are discussed.

536.48 : 536.712 : 534.22 287

The second virial coefficient of helium at temperature of liquid and solid hydrogen. KEESOM, W. H., AN WALSTRA, W. K. *Commun. K. Onnes Lab. Leiden* (*N* 271*a*). *Physica, 's Grav.*, **13**, 225–30 (*May*, 1947).- Isotherms of He were measured to determine values the second virial coefficient from 9·6 to 20·5°K. Th results, given in a table, are compared with those previous authors and with measurements of the velocit of sound.

536.48 : 541.183.56 *see Abstr.* 2996

536.626.2 : 536.662 287

Researches on heat of combustion. I. Method ar apparatus. COOPS, J., VAN NES, K., KENTIE, A., AN DIENSKE, J. W. *Rec. Trav. Chim. Pays-Bas*, **66**, 113–3 (*March–April*, 1947).—The construction and theory of a isothermally jacketed calorimeter are described. Th calorimeter vessel, a thin-walled Cu cylinder of ov cross-section, heavily nickelled and polished on the ou side, is supported on three pivots and is thermall insulated from the surrounding water jacket by an a layer. The calorimeter contains: a metal Dewar insid which are placed the bomb and heating element; Beckmann thermometer placed between the Dewar an the calorimeter wall; and a centrifugal stirrer, place above the lid of the Dewar, to circulate the wat ($\sim 1\,500$ cm³) filling the calorimeter. S. V

.626.2 : 536.662 2878
tesearches on heat of combustion. II. Internal lag and hod of stirring in isothermally jacketed calorimeters. OPS, J., AND VAN NES, K. *Rec. Trav. Chim. Pays-Bas*, 131–41 (*March–April*, 1947).—More details are given the centrifugal stirrer. It is shown that, in order to rect accurately for thermal leakage and to allow for t of stirring, the calorimeter wall temp. must be the ne throughout and be recorded directly by the thermo- ter. The effect of internal lag is discussed, and from a given in I [Abstr. 2877 (1947)] it is calculated that to asure the heat of combustion to within 0·01% the in period must be 10× the time required for the orimeter temp. to rise to ¾ of its final value. S. W.

.626.2 : 536.662 2879
Researches on heat of combustion. III. The use of the kmann thermometer as a very accurate instrument for in isothermally jacketed calorimeters. COOPS, J., VAN NES, K. *Rec. Trav. Chim. Pays-Bas*, **66**, 142–52 *arch–April*, 1947).—By following a definite procedure d taking particular precautions (both fully described, h diagrams of the auxiliary apparatus) it is concluded t a temp. difference of 0·0001° can be measured on an linary Beckmann thermometer graduated in 0·01° ervals. S. W.

6.626.2 : 536.662 2880
Researches on heat of combustion. V. Correction for at exchange between calorimeter vessel and its surroundings. COOPS, J., AND VAN NES, K. *Rec. Trav. Chim. ys-Bas*, **66**, 161–76 (*March–April*, 1947).—The water- ket, and the thermoregulator which maintains the ket temp. constant to within 0·002°, are described in tail. The question as to how wide the air layer between lorimeter and water jacket may be before convection curs, and various methods of approximation for lculating the "radiation" loss integral, are discussed. S. W.

6.63/.65 : 536.75 *see Abstr.* 2885

6.631.08 : 536.42 2881
Measurement by induction heating of the temperature riations of the specific heats of ferromagnetic materials. TCHISON, G. J. *J. Sci. Instrum.*, **24**, 200–2 (*Aug.*, 47).—In a suitably designed h.f. induction furnace, it as possible to supply heat to a specimen at a rate which nained approximately const. over a wide temp. range. measuring the rates of temp. rise at different temps., d correcting for cooling, graphs could be obtained owing approximately the variation of sp. ht with temp. ch graphs are of interest in indicating changes of state the material of the specimen. A.

6.662 2882
Researches on heat of combustion. IV. Technique for the termination of the heats of combustion of volatile liquids. OOPS, J., MULDER, D., DIENSKE, J. W., AND SMITTENBERG, J. *Rec. Trav. Chim. Pays-Bas*, **66**, 153–60 (*March–ril*, 1947).

6.662 : 536.626.2 *see Abstr.* 2877–80

THERMODYNAMICS 536.7/.8

6.7 = 4 2883
On the calculation of the total entropy of a mixture of rfect gases. MANSON, N. *C.R. Acad. Sci., Paris*, **224**, 48–50 (*June* 2, 1947) *In French.*

6.7 = 4 2884
On the calculation of the entropy and enthalpy of a ixture of perfect gases by the mixture rule. MANSON, N. *.R. Acad. Sci., Paris*, **224**, 1816–18 (*June* 30, 1947) *In ench.*

536.71 : 541.126 : 533.75 *see Abstr.* 2798

536.711 : 539.16.08 : 533.2 : 536.423.4 *see Abstr.* 2871

536.711 : 539.16.08 : 536.423.4 *see Abstr.* 2870

536.712 : 534.22 : 536.48 *see Abstr.* 2876

536.75 : 536.63/.65 2885
The entropy of nitromethane. Heat capacity of solid and liquid. Vapor pressure, heats of fusion and vaporization. JONES, W. M., AND GIAUQUE, W. F. *J. Amer. Chem. Soc.*, **69**, 983–7 (*May*, 1947).—The heat capacity of nitromethane has been determined from 13–300°K. The m.p. is 244·73°K and the heat of fusion is 2 319 g.cal/mole. The v.p. at 25° is 3·666 cm and the heat of vaporization at this temperature was determined calorimetrically to be 9 147 g.cal/mole. The entropy of nitromethane in the ideal gas state at 298·1°K and 1 atm. has been calculated as 65·73 g.cal/deg./mole. These data have been used to calculate the 6-fold potential barrier restricting internal rotation in the molecule, 500 g.cal/mole, and this value has been compared with previously recorded values. W. R. A.

536.764 : 539.388.8 : 539.374 2886
Thermodynamic relations for two phases containing two components in equilibrium under generalized stress. GURNEY, C. *Proc. Phys. Soc. Lond.*, **59**, 629–45 (*July*, 1947).—The application of thermodynamics to cases of other than hydrostatic pressure is important in connection with the swelling and flow and fracture of solids under generalized stress. In the present paper the methods of Gibbs are applied to the case of two phases containing the same two component substances in equilibrium with each other. The problem is first considered in its most general form, each phase being under generalized stress and each containing each component. The problem in which one of the components is absent from one of the phases is then considered, and the case in which one of the phases is fluid and able to withstand only hydrostatic pressure, is dealt with in detail. The derivatives of pressure on the fluid phase for changes of temp. and changes of each of the components of generalized stress on the solid phase are given. When suitably interpreted, the same formulae apply to both solution and swelling. Formulae for entropy changes with stress and temperature are also given, and the use of other independent variables such as strain, force, and displacement instead of stress is discussed. A.

ELECTRICITY 537

537.122 : 531.18 : 530.12 *see Abstr.* 2768

537.133 : 778.3 : 539.164.1 *see Abstr.* 2967

537.226 : 548.0 2887
Dielectric properties of single crystals of barium titanate. HULM, J. K. *Nature, Lond.*, **160**, 127–8 (*July* 26, 1947).—Single crystals [Abstr. 2997 (1947)] were tested with fields up to 30 kV/cm, and typical hysteresis loops observed below ~124°C. Extrapolation to zero field of the saturated value shows a polarization value of a single domain of ~16 μcoulombs/cm² (cf. ~5·3 for polycrystalline specimens). The polarization falls above ~110°C, linearly above ~130°C. Permanent polarization still exists at 20°K; coercive field >, and max. polarization <, at room temp.

537.228.1 2888
Piezo-electric substances. BRUZAU, M. *Elect. Commun.*, **23**, 445–59 (*Dec.*, 1946).—A translation of a monograph, "*Les substances piézoélectriques synthétiques*," published in 1940, still of interest from the point of view of classification. The history of and tests for

piezo-electricity are reviewed and the known piezo-electric substances are tabulated according to their crystal systems. The properties and applications of Rochelle salt are discussed and the piezo-electric constants of other artificial crystals are given. P. O.

537.228.1 : 548.0 *see Abstr.* 2997

537.228.1 : 621.396.611.21 2889

First and second order equations for piezo-electric crystals expressed in tensor form. MASON, W. P. *Bell Syst. Tech. J.*, **26**, 80–138 (*Jan.*, 1947).—Stress or strain components are defined and Hooke's law is generalized for aeolotropic media. The inter-relation of isothermal and adiabatic elastic constants is considered and expressions given for elastic, piezo-electric, pyro-electric and dielectric constants in the general case. The general properties of tensors are discussed and their application to elastic and other properties of crystals illustrated by derivation of such tensors for the various constants for each class of crystal symmetry. Second order effects are considered, and their equations used to discuss the spontaneous polarization occurring in ferro-electric crystals, with particular reference to Rochelle salt, for which the second order constants are evaluated. P. O.

537.228.5 : 535.343.4–14 *see Abstr.* 2839

ELECTRIC CURRENTS 537.3

537.311.31 : 539.23 2890

Measurements on the electrical resistivity of thin nickel films. VAN ITTERBEEK, A., AND DE GREVE, L. *Experientia*, **3** (*No.* 7) 278–9 (1947).—The phenomena previously reported [Abstr. 2605 (1946)] were found to be accompanied by a departure from Ohm's law; the resistance fell if the current was increased. The effects are due to imperfect crystallization; several hours' heat at 150°C converts the films to ohmic conductors with pos. coefficients.

537.311.33 : 537.312.5 *see Abstr.* 2897

537.311.33 : 537.312.9 2891

Effect of bending on selenium rectifier disks. SELÉNYI, P. *Nature, Lond.*, **160**, 197 (*Aug.* 9); *erratum*, 326 (*Sept.* 6, 1947).—The effect is to produce a temporary increase of the current flowing through the disc, specially marked in the reverse direction (increase up to 300%). The effect increases with voltage and with force, but is lower and decay is more rapid at 40–50°C than at room temp. The effect is ascribed to the dissociation of impurity centres under the simultaneous action of electric field and shearing stress in the blocking layer.

537.311.33 : 537.323 2892

Semiconducting properties of stannous sulphide. II. Thermoelectric effect. ANDERSON, J. S., AND MORTON, M. C. *Trans. Faraday Soc.*, **43**, 185–94 (*April*, 1947).—Measurements were made of the electrical conductivity and thermo-electric power of plates of SnS of varying degrees of S excess between −80°C and 420°C. For specimens of small S excess the thermo-electric power reverses sign at high temp. because the intrinsic electron conductivity of SnS outweighs the positive hole conductivity, and hence high conductivity can exist for zero thermo-electric power. The Fowler–Wilson theory does not explain the results quantitatively. It is found that the mean free path of the electrons and the activation energy vary with conc. of impurity centres. M. H. F. W.

537.311.33 : 537.323 2893

Semiconducting properties of lead sulphide. MORTON, M. C. *Trans. Faraday Soc.*, **43**, 194–201 (*April*, 1947).—The electrical conductivity and thermo-electric power of pressed powder specimens of PbS, with excess of either Pb or S, were measured from −80°C to 350°C. Measurements on materials of progressively changing composition showed a change from electron conduction to positive hole conduction as would be expected. The activation energy decreased with increasing conductivity, but the number of conducting centres had a min. value corresponding to stoichiometric composition. The electron-freeing activation energy < the positive-hole-freeing energy, and for specimens of min. conductivity both conduction processes took place and the thermo-electric power changed sign with temp. When the conductivity was due primarily to one conduction process the thermo-electric power was constant. M. H. F. W.

537.311.33 : 539.11 : 536.212 : 538.224 : 535.342 2894

Erratum: The band theory of graphite. WALLACE, P. R. *Phys. Rev.*, **72**, 258 (*Aug.* 1, 1947).—See Abstr. 1864 (1947).

537.311.33 : 621.315.59 2895

Semi-conductors. MASSEY, H. S. W. *J. Sci. Instrum.*, **24**, 220–4 (*Aug.*, 1947).—A short non-mathematical review of the theory of semi-conductors, including a discussion of the thermal variation of electrical conductivity and Hall effect; correlation of conductivity with concentration of impurity; contact between metal and semi-conductor; Peltier and Seebeck effects; rectification; and optical properties of semi-conductors.

537.312.5 2896

Electromotive force and internal resistance of blocking layer photo elements. SANDSTRÖM, A. E. *Ark. Mat. Astr. Fys.*, **34 B** (*Paper* 9) 7 *pp.* (1947).—Curves of current against voltage produced in Se rectifier photocells show that the blocking layer constitutes a resistance not only for back flow of electrons but also for total photocurrent. A circuit model for the photocell is accordingly proposed. The decrease of blocking layer resistance with light intensity is measured. M. H. F. W.

537.312.5 : 537.311.33 2897

The positive rectifying photo-electric effect in selenium KOLOMIETZ, B. T. *C.R. Acad. Sci. URSS*, **55** (*No.* 3) 207–8 (1947).—Rectifier photocells made with Se with Tl added can give either pos. or neg. photovoltaic effects though the spectral sensitivity curves are similar. The direction of rectification of such photocells shows that the semi-conductor is in both cases a "hole" conductor though theoretically the change in direction of the photovoltaic effect would be expected to be associated with a change from "hole" conductivity to electron conductivity. No theoretical explanation is provided. M. H. F. W.

537.312.62 289

Magnetic threshold curves of superconductors. DAUNT J. G. *Phys. Rev.*, **72**, 89–90 (*July* 1, 1947).—In comparing the T^2 and the $T^{3/2}$ variation of magnetic threshold field with temp. [Abstr. 1528, 2153 (1947)] the author points out that the impurity effects are very important in this case, and suggests that the results on Hg provide the best test between these alternatives. These results definitely favour the T^2 variation. W. E. D

537.312.62 289

Superconductivity and the Debye characteristic temperature. DE LAUNAY, J., AND DOLECEK, R. L. *Phys. Rev.*, **72**, 141–3 (*July* 15, 1947).—A plot of the superconducting threshold temps. as a function of the Debye characteristic temps. of the known superconducting elements discloses empirical relationships, which are used to discuss the occurrence of superconduction among other elements. It is concluded that Sc, Y, and Sm are no

y to be found superconducting, but that Ce, Pr, Nd, Ac (should its atomic volume prove to be ~ n³/mole) are expected to be superconducting. Data ³a is very incomplete. The best that can be inferred :at Pa should be superconducting with a threshold ›. > 2°K. A.

312.62 : 537.32 2900

ie thermo-electric behaviour of a superconductor in the hbourhood of the transition point. CASIMIR, H. B. G., RADEMAKERS, A. *Commun. K. Onnes Lab. Leiden* .270*d*). *Physica, 's Grav.*, **13**, 33–40 (*March*, 1947).— :ry sensitive method is described for the measurement ie thermo-e.m.f. in a circuit, consisting of Sn and Pb, - the transition point of Sn. The measurements con- Matthijs' conception [Abstr. 3040 (1938)] that, with ering temp., superconductivity is preceded by a sharp ige of the thermo-electric force, and is thus an- nced already at temp. above the transition point. A.

.312.62 : 538.223 *see Abstr.* 2941

.312.8 : 538.639 : 536.21 2901

he theory of the magneto-resistance effects in metals. DHEIMER, E. H., AND WILSON, A. H. *Proc. Roy.* . *A*, **190** 435–55 (*Sept.* 9, 1947).—General formulae obtained for the effect of a magnetic field on the :trical and thermal conductivities of a metal in which re are two overlapping bands of normal form. Simple mulae are set up which, though not strictly valid for all peratures and fields, reduce to the correct expressions he 3 limiting cases of high temp., low temp. and very ng magnetic fields. The behaviour of the electrical stance at low temp. is discussed, and it is shown that certain cases the resistance may pass through a min. the temp. is increased provided the magnetic field is ge enough. It is also shown that in general the Lorenz mber is increased by the presence of a magnetic field, t that the thermal conductivity of the lattice is un- ected by a magnetic field. A.

7.312.9 : 537.311.33 *see Abstr.* 2891

7.32 : 537.312.62 *see Abstr.* 2900

7.323 : 537.311.33 *see Abstr.* 2892–3

7.33 : 539.23 = 4 2902

Propagation of electric charges on thin poorly-conducting ns. "Plane problem." DESTRIAU, A. *J. Phys. adium* (*Sér.* 8) **7**, 43–8 (*Feb.*, 1946) *In French.*—Earlier lculations for the linear case [*ibid.*, **4**, 239 (1943)] are re extended to circular electrodes, and it is shown that is possible to have significant asynchronism between the ltage at the centre and at the periphery, even though e voltage drop may be small. Experiments confirm the edictions of the theory. A.

LECTRIC DISCHARGES AND RADIATIONS 537.5

7.52 2903

Electrical discharge through gases. LOEB, L. B. *Instn Elect. Engrs, Pt I*, **94**, 349–54 (*Aug.*, 1947).— n up-to-date and complete review of the fundamental rocesses and mechanisms of gaseous electrical con- uction, with a bibliography of 90 references. J. D. C.

37.523.4 : 537.534.8 2904

Minimum sparking potentials of barium, magnesium, nd aluminum in helium. JACOBS, H., AND LAROQUE, . P. *Trans. Electrochem. Soc.*, **91** (*Prepr.* 20) 14 *pp.* .947).—The values determined experimentally were ound to be 146 ± 2, 161 ± 1, and 187 ± 2 V, and re compared with those in A; in general, they are higher. rom the data presented, the γ (ratio of secondary emission to positive ion bombardment) values of Ba, Mg, and Al in He are calculated. The comparison of He with A also provides the possibility of discussion of the mechanism of γ from a quantitative viewpoint and the following theories are discussed: (1) recombination energies; (2) field emission from the positive ion sheath; (3) ionic mobility; (4) ion adsorption; (5) mean life of a molecule on the surface. It is thought that the last gives the greatest quantitative consistency with experiment. The predictions made by Cobine and Loeb are discussed and it is shown that values calculated by using their formulae are approximate but not exact for obtaining minimum sparking potentials and pressure × distance at the minimum sparking potentials. A.

537.523.4 : 621.3.015.5 : 621.317.333.6.029.64 2905

Experiments on the electric strength of air at centimetre wavelengths. COOPER, R. *J. Instn Elect. Engrs, Pt III*, **94**, 315–24 (*Sept.*, 1947).—[Abstr. 2443 B (1947)].

537.525.8 2906

Comparative studies of the Joshi-effect with a vacuo-junction and diode detection. PRASAD, B. N. *Indian J. Phys.*, **29**, 187–92 (*Oct.*, 1946).—Production of the effect [Abstr. 2304 (1945)], an instantaneous and reversible photo-diminution Δi of the discharge current i, is studied in Cl excited by 2·6 kV at 50 c/s. A vacuo-junction and double diode (the latter being coupled inductively and resistively with the l.t. of the ozonizer) served as detectors. As established by Joshi, Δi does not occur below the "threshold potential" and $\Delta i/i$ is max. near it. Based on Joshi's result that Δi predominates in the h.f. part of i, an explanation is developed for Joshi's general finding that $\Delta i/i$ decreases on increasing the circuit resistance, on an analysis of the behaviour of the h.f., l.f. and supply frequency parts of i in terms of the corresponding damping and skin effects. See Abstr. 2307 (1945). A.

537.525.8 = 4 2907

Physical significance and measurement of the time constant of current flow in a gaseous discharge. MOUSSIEGT, J. *C.R. Acad. Sci., Paris*, **224**, 1490–2 (*May* 28, 1947) *In French.*—A contribution to the study of intermittent discharges in low pressure gases. For the case of a capacitor discharge an equation is given relating circuit capacitance, duration of discharge, slope of discharge characteristic, circuit resistance and discharge current. J. D. C.

537.531 : 535.34 : 535.43 2908

A theory of X-ray absorption in mixed powders. DE WOLFF, P. M. *Physica, 's Grav.*, **13**, 62–78 (*March*, 1947).—General formulae are derived for the effect of particle size on absorption and on the intensity scattered by one of its components. They are based on a one-dimensional model, but it is shown that they require only a small correction in order to become useful for real powders, even if these are rather coarse. A.

537.531 : 535.42 = 4 2909

Non-homogeneous distribution of the intensity of the X-ray beam obtained from radiotherapy tubes. REBOUL, J.-A. *C.R. Acad. Sci., Paris*, **224**, 1708–9 (*June* 16, 1947) *In French.*—Special slow-emulsion films placed perpendicular to the beam showed a roughly cruciform fogging, crossed by light and dark bands. The cross is a geometrical penumbra resulting from the internal diaphragm of the tube and the rectangular Pb diaphragm of the localizer. It is due to a defect in design and is not observed with all tubes. The bands are attributed to diffraction of secondary X-rays by Ag halide crystals in the emulsion. A. J. C. W.

537.531 : 539.155.2 2910

Researches on a stable isotope of atomic number 84. HULUBEI, H., AND CAUCHOIS, Y. *C.R. Acad. Sci., Paris*, **224**, 1265–6 (*May* 5, 1947) *In French.*—Roumanian petzites contain between 1 in 10^9 and 1 in 10^6 of a stable isotope of Po. Its concentration can be followed by observation of X-ray emission spectra with a focusing spectrometer. A. J. C. W.

537.533 : 535.215.1 = 4 2911

Discussion of the formulae and theoretical curves concerning the angular distribution of photo-electrons. MORETTE, C. *J. Phys. Radium* (*Sér.* 8) **7**, 135–8 (*May*, 1946) *In French.*—A theoretical expression is given for the angular distribution of photo-electrons as a function of a quantity, χ, which depends on the energy of the incident photon and the irradiated elements. Curves are given showing the variation of χ with $h\nu$, the energy of the incident photon for various metals. Curves are also given for the same metals for the variation of angle of max. emission with $h\nu$. Similar curves are given for the angle which generates a cone such that the number of photo-electrons ejected with directions included in the cone is $\frac{1}{2}$ the total number emitted. W. E. D.

537.533.1 : 530.145.6 *see Abstr.* 2779

537.533.72 : 539.163.2 *see Abstr.* 2964

537.533.72 : 539.165.08 2912

Errata: The double focusing beta-ray spectrometer. SHULL, F. B., AND DENNISON, D. M. *Phys. Rev.*, **72**, 256 (*Aug.* 1, 1947).—See Abstr. 2167 (1947).

537.533.72 : 621.385.833 2913

Spherical aberration of compound magnetic lenses. MARTON, L., AND BOL, K. *J. Appl. Phys.*, **18**, 522–9 (*June*, 1947).—[Abstr. 2532 B (1947)].

537.533.74 : 530.145 *see Abstr.* 2778

537.534 : 621.385.82 2914

Theory of the proton synchrotron. GOODEN, J. S., JENSEN, H. H., AND SYMONDS, J. L. *Proc. Phys. Soc., Lond.*, **59**, 677–93 (*July*, 1947).—[Abstr. 2525 B (1947)].

537.534 : 621.385.82 2915

The acceleration of charged particles to very high energies. OLIPHANT, M. L., GOODEN, J. S., AND HIDE, G. S. *Proc. Phys. Soc., Lond.*, **59**, 666–77 (*July*, 1947).—[Abstr. 2524 B (1947)].

537.534.72 : 545.827 2916

A mass spectrometer for isotope and gas analysis. NIER, A. O. *Rev. Sci. Instrum.*, **18**, 398–411 (*June*, 1947).—A mass spectrometer suitable for routine isotope analyses of the lighter elements is described. Complete electronic circuits are given. An all-metal mass spectrometer tube is employed. A null method of determining relative abundances of the elements C, N and O is used [Abstr. 2917 (1947)]. Although designed primarily for analysing elements for which separated isotopes are available as tracers, the instrument may be modified for use over the entire atomic table or for making gas analyses. A.

537.534.72 : 621.317.311.083.4 2917

A null method for the comparison of two ion currents in a mass spectrometer. NIER, A. O., NEY, E. P., AND INGHRAM, M. G. *Rev. Sci. Instrum.*, **18**, 294–7 (*May*, 1947).—[Abstr. 2441 B (1947)].

537.534.74 = 4 2918

Effect of Coulomb scattering on cloud chamber measurements. RICHARD-FOY, R. *J. Phys. Radium* (*Sér.* 8) **7**, 370–6 (*Dec.*, 1946) *In French.*—The law of scattering in a Coulomb field, and the range of validity of pure multiple scattering are reviewed. The spurious curvature of a cloud chamber track arising from this scattering in th gas of the chamber is discussed in detail. See als Abstr. 989 (1947). J. G. W.

537.534.8 : 537.523.4 *see Abstr.* 2904

537.542 291

Time lags in Geiger–Müller counters. DEN HARTOG, H MULLER, F. A., AND VERSTER, N. F. *Physica, 's Grav* **13**, 251–64 (*May*, 1947).—Describes a method of measu ing electron drift velocities in the lower field-strengt region of Geiger–Müller counters, where considerabl time-lags may occur owing to the electron transit time In a 7-cm dia. counter filled with 90 mm of A and 10 mm of alcohol vapour, the max. time-lag is $\sim 2\mu$sec. Th time-lag $\propto$ (dia.)^2, indicating a true electron mobilit independent of field strength. A discussion is given o the factors governing electron mobilities in counter containing gas-vapour mixtures. Argon appears to b especially well adapted to high-resolution counting. A

537.542 292

Construction of Geiger–Müller tubes of high sensitivit to β-radiations. ELLIOTT, G. A., AND LEE, R. H. *Rev Sci. Instrum.*, **18**, 450–1 (*June*, 1947).—Describes hov thin (0·2 mm) Pyrex-walled counters can be produced b etching with HF. A metallic cathode is deposited o the inside. L. E. M

537.542 = 4 292

A glass-walled counter with external cathode. MAZE, R *J. Phys. Radium* (*Sér.* 8) **7**, 164–6 (*June*, 1946) *In French.*— The normal cylindrical glass-walled type of G–M counte is modified to have as its cathode a graphite coatin outside the glass. The counter behaves as though th inner glass surface were a conducting cathode connecte by a parallel capacity and high resistance to the earthe external coating. Soda glass is used to give a lowe resistance ($\sim 10^8\ \Omega$) than Pyrex. An improved plateau and absence of parasitic discharges is obtained with los of no other characteristics. L. E. M

537.56 : 539.163.2 *see Abstr.* 2965

537.561 292

Ionization and dissociation of *cis*- and *trans*-2-butene by electron impact. DIBELER, V. H. *J. Res. Nat. Bur Stand., Wash.*, **38**, 329–36 (*March*, 1947).—A study ha been made of the appearance potentials and relative abundance of ions by mass spectra. The former were found to be in generally good agreement with spectro scopic data. The mass spectra of the 2-butenes were compared with those of 1-butene and isobutene. The $C_2H_3^+$ ion was found to be the only ion showing a significant difference between the 2-butene isomers This difference approached a max. with 40-eV ionizing electrons and remained const. up to 100 eV. A

537.565 = 4 2923

Ions in gases—determination of the mobilities of heavy ions in gases at rest. VASSAILS, G. *C.R. Acad. Sci., Paris*, **224**, 1820–2 (*June* 30, 1947) *In French.*—Continuation of Abstr. 2622 (1946). F. L. J.

537.58 : 548.0 : 541.183.5 = 3 2924

The electron emission of crystalline metal surfaces and its relation to the laws of crystal structure. I. Pure single-crystal surfaces. II. Single-crystal surfaces with adsorbed foreign atoms. STRANSKI, I. N., AND SUHRMANN, R. *FIAT Rep.* (*Nos.* 1030–1) (*H.M. Station. Off.*; *U.S. Dep. Comm.*) 22+14 *pp.* (1947) *In German.*—A discussion based on the experiments of others. I. The ease of emission of electrons from W depends on the emitting face. The work function $\simeq \frac{1}{2}$ the energy required to remove an atom from a "step" on the same face, but is not simply related either to the density of packing of atoms in the

or to the specific surface energy. Conditions for the irrence of given faces are derived in terms of the gies of interaction between nearest, next nearest, atoms. II. If the foreign atoms are about the same as W atoms they are adsorbed preferentially on faces high specific surface energy. If the sizes are greatly rent they are adsorbed preferentially where they best o that the 001 faces of W adsorb atoms of diameters 4·5, 6·3, 8·9, . . . Å, the 011 faces atoms of diameters 5·4, . . . Å, and the 111 faces atoms of diameters 4·5 ·9 Å. These agree with experiments on the electron ssion from W crystals with adsorbed Cs and Ba; the ns are adsorbed as such and not as ions. Values are ıced for the energy of adsorption of Cs atoms in ous locations. A. J. C. W.

583 : 621.385.032.216 2925

ermionic properties of thoria. WRIGHT, D. A. *ure, Lond.*, **160**, 129–30 (*July* 26, 1947).—The emission athodes of thoria coatings and solid thoria was stigated. The mean value of the work function was and did not rise [see Abstr. 516 (1946)] during running, fall in emission being due to a fall in the Richardson onstant. Mean emission values of 2·5 A/cm² at 0°K were obtained with coated cathodes, and higher es under pulsed conditions. Currents of 10 A/cm² and 30 A/cm² pulse were drawn without "sparking" flashing," which may be due to the low resistivity of coating, and the absence of a potential barrier at the l/semi-conductor boundary. Thermal emissivity at 0°K was 0·5 (40 W/cm² radiated).

COSMIC RAYS 537.591

591.1 = 3 2926

re protons a primary component of cosmic rays? KER, K.-H. *Z. Naturforsch.*, **2a**, 69–72 (*Feb.*, 1947) *erman.*—A discussion based on experimental material o about 1945. J. G. W.

591.1 = 4 2927

obable existence of a particle of mass 990 m_0 in ic rays. LEPRINCE-RINGUET, L., AND LHÉRITIER, M. *ays. Radium* (*Sér.* 8) **7**, 66–9 (*March*, 1946) *In French.*—estimate of mass, 990 $m_0 \pm 12\%$ is obtained by the od of elastic collision for a penetrating particle ographed at 1 000 m altitude. Other particles in the series of photographs show collisions consistent the normal meson mass. J. G. W.

591.1 = 4 2928

vestigations of fast protons and mesons in the pene-ng component of cosmic rays. LEPRINCE-RINGUET, L., RITIER, M., AND RICHARD-FOY, R. *J. Phys. Radium* 8) **7**, 69–74 (*March*, 1946) *In French.*—The pene-ng component, filtered in 12 cm Pb, was studied at m altitude in a cloud chamber 75 cm long in a of 3 000 gauss. Found: (*a*) particles recognizable as ons, which were 3% of all particles in the momentum e over which recognition was possible; (*b*) particles h were recognizable as mesons; (*c*) 5 particles in 00 photographs of curvature and ionization density eating a mass intermediate between protons and ons. J. G. W.

591.15 2929

ocal and extensive penetrating cosmic ray showers. ADBENT, D., AND JÁNOSSY, L. *Proc. Roy. Soc. A*, 497–507 (*Sept.* 9, 1947).—Penetrating cosmic ray vers were observed with an anticoincidence method h indicated whether or not each shower was asso-d with an extensive air shower. Those not associated extensive showers (local penetrating showers) were found to show a mass-proportiona transition effect, while the others (extensive penetrating showers) showed a strongly Z-dependent transition effect, very like the Rossi transition effect of cascade showers. It is concluded that these are two completely independent types of penetrating showers, the local showers being groups of mesons produced in absorbers near the apparatus by single fast primary nucleons, and the extensive penetrating showers being large cascade showers containing penetrating particles. This separation is shown to accord well with previous observations. A.

537.591.15 2930

The transition effect for large bursts of cosmic-ray ionization. II. MONTGOMERY, C. G., AND MONTGOMERY, D. D. *Phys. Rev.*, **72**, 131–4 (*July* 15, 1947).—See Abstr. 4302 (1939). Observations were made of the bursts of cosmic-ray ionization in a chamber covered by thin plates of Pb, Fe and Mg. From the observed multiplications of the numbers of rays in the shield, it is possible to separate the bursts of ionization caused by large atmospheric showers from bursts caused by heavily ionizing particles ejected from the chamber walls. Knowledge of the number of atmospheric showers allows the energy spectrum of the cosmic-ray electrons in the high atmosphere to be calculated. The integral spectrum is found to follow a power law with the exponent $-3\cdot1$ in the region near 2×10^{15} eV. A.

537.591.15 = 3 2931

Studies of cosmic ray showers in a large cloud chamber. DEUTSCHMANN, M. *Z. Naturforsch.*, **2a**, 61–9 (*Feb.*, 1947) *In German.*—The density spectrum of atmospheric showers is compared with that deduced from burst measurements, and the angular distribution in the showers with that of single particles. J. G. W.

537.591.15 : 523.6 2932

Auger showers and the comets. ROJANSKY, V. *Phys. Rev.*, **71**, 552 (*April* 15, 1947).—Klein's conjecture [*Ark. Mat. Astr. Fys.*, **31 A** (*Paper* 14) (1945)] that Auger showers are produced by matter having negative nuclei, and Rojanski's conjecture that comets consist of this type of matter could be tested by cosmic ray experiments during the period of meteor showers in August. W. E. D.

537.591.2 2933

Measurement of the slow meson intensity at several altitudes. ROSSI, B., SANDS, M., AND SARD, R. F. *Phys. Rev.*, **72**, 120–5 (*July* 15, 1947).—The number of mesons stopped by a 2-in horizontal Al plate was measured at several altitudes between sea level and 35 000 ft. The mesons were detected by recording the delayed emission from the absorber of the electrons produced by the decay of the absorbed mesons. An increase by a factor of ~ 37 between sea level and 35 000 ft was observed. A.

537.591.5 2934

Solar magnetic field and diurnal variation of cosmic radiation. ALFVÉN, H. *Phys. Rev.*, **72**, 88–9 (*July* 1, 1947).—Arguments are put forward to show that the solar magnetic field cannot produce a diurnal variation. W. E. D.

537.591.5 : 539.185 *see Abstr.* 2985

MAGNETISM 538

538.114 = 4 2935

Bases of a new general theory of coercive force. NÉEL, L. *Ann. Univ. Grenoble*, **22**, 299–341 (1946) *In French.*—It is shown that previous theories of coercive force, assuming displacements of a boundary between domains, are insufficient to account for the observed order of magnitude. The new theory suggests a mechanism based

on the existence of fluctuations in direction and intensity of spontaneous magnetization in the interior of domains. Calculated values of coercive force are in agreement with observed values. A. E. D. B.

538.114 : 539.153 *see Abstr.* 2953–4

538.12 : 621.317.44 = 3 2936

Torque of a homogeneous, magnetized sphere in a magnetic field. Halla, F., and Castelliz, L. *Öst. Ingen. Arch.*, **1** (*No.* 3) 230–4 (1946) *In German.*—The torque exerted by the sphere in a field at right angles to its magnetization is calculated for 2 cases: (*a*) the field of a circular conductor, (*b*) the field of a solenoid. Curves for the numerical integration for Schultz magnetometer conditions [*Physica*, **6**, 137 (1939)] are then given. H. G. S.

538.221 = 4 2937

On the remanent magnetisation of αFe_2O_3. Roquet, J. *C.R. Acad. Sci., Paris*, **224**, 1418–20 (*May*, 1947) *In French.*—Measurements are given of the remanent magnetization of αFe_2O_3 from fields up to 32 300 oersteds. From this field strength $\sigma_r = 0{\cdot}107$ e.m.u. The effect of applied fields on the remanent magnetization is also studied. A. E. D. B.

538.221 : 539.156 2938

Ferromagnetic resonance at microwave frequencies. Yager, W. A., and Bozorth, R. M. *Phys. Rev.*, **72**, 80–1 (*July* 1, 1947).—Measurements were made with "supermalloy" on the resonance phenomenon caused by interaction of the precessing electrons and the magnetic field. The resonance frequency of the cavity, details of which are given, was 24 050 Mc/s and resonance occurred at a corrected field value of 4 920 oersted, leading, on Kittel's theory [Abstr. 1574 (1947)], to a value for the Landé splitting factor of 2·17. As a value $\neq 2$ is expected, it is suggested the theory may require modification. W. E. D.

538.222 2939

The magnetic susceptibilities of the vapors of benzene and carbon tetrachloride. Reber, R. K., and Boeker, G. F. *J. Chem. Phys.*, **15**, 508–13 (*July*, 1947).—An apparatus has been constructed for measuring the magnetic susceptibility of vapours at elevated temps and at independently controlled pressures. Greater accuracy than has been attained previously is claimed. Determinations of the susceptibilities of the vapours of benzene and CCl_4 have been made at 110°C. The limits of uncertainty in the results are $\sim 3\%$. The values found for the mass susceptibilities are in very close agreement with values which have been obtained for the liquids. A.

538.222 = 5 2940

Magnetic properties of wüstite [Fe_3O_4, FeO]. Cirilli, V. *Ric. Sci. Ricostruz.*, **15**, 557 (*Dec.*, 1945) *In Italian.*—Contrary to the hypothesis of a solid solution Fe_3O_4 in FeO, susceptibility remains const. within a considerable range of O:Fe values. The substance is paramagnetic. J. A. W.

538.223 : 537.312.62 2941

Magnetic susceptibility of sodium in liquid ammonia solutions at low temperatures. Gibney, R. B., and Pearson, G. L. *Phys. Rev.*, **72**, 76–7 (*July* 1, 1947).—The volume diamagnetic susceptibility was measured against conc. in the temp. region where previous workers had reported superconductivity [Abstr. 878 (1947)] and in no case was a value $> 10^{-6}$ found, whereas a perfect superconductor would have a value $\frac{1}{4}\pi$. W. E. D.

538.224 : 535.342 : 539.11 : 536.212 : 537.311.33 *see Abstr.* 2894

ELECTROMAGNETISM
ELECTRODYNAMICS 538.3/.5

538.541 : 621.3.017.2/.3 29

On the theory of eddy currents in ferromagnet materials. Casimir, H. B. G. *Philips Res. Rep.*, **2**, 42-(*Feb.*, 1947).—The theory is developed for the limiti case in which the depth of penetration d is small althou the product μd is not necessarily small. The rigoro solution for the sphere is first discussed for this limiti case. It is then shown that the solution can be obtain from Laplace's equation with a new type of bounda condition. This condition is then applied to a discussi of eddy currents in spheroids. Explicit formulae a found both for small and for very large values of μd (R = rad. of sphere). Special attention is given to t limits for very long and very flat spheroids.

538.566 : 621.3.015.1 : 621.392.26 29

Laws of potential distribution along slits. Feld, J. *C.R. Acad. Sci. URSS*, **55** (*No.* 5) 407–10 (1947). [Abstr. 2544 B (1947)].

MAGNETIC EFFECTS 538.6

538.615 : 535.338.3 *see Abstr.* 2831

538.639 : 536.21 : 537.312.8 *see Abstr.* 2901

ATOMIC AND MOLECULAR STRUCTURE 5

539.11 : 530.145.6 *see Abstr.* 2780

539.11 : 536.212 : 538.224 : 535.342 : 537.311.33 *see Abstr.* 2894

539.132 2

The potential function of ethane. Bak, B. *K. Dan Vidensk. Selsk. Mat.-fys. Medd.*, **24** (*No.* 1) 27 (1946).—The equations between the vibration frequenc of ethane and hexadeuteroethane and the force-consta of the general quadratic potential function have b found, for both the D_{3d} and the D_{3h} model. Numeri values are found for all the force-constants of the n degenerate classes, and their dependence on the f quency numbers is demonstrated. The use of "empirical rule" in the case of the degenerate clas leads to error. Attempts to find the error by a physi analysis meet with difficulties, the fundamental featu of which have been emphasized.

539.132 2

The size and vibration frequency of the excited benz molecule. Griffing, V. *J. Chem. Phys.*, **15**, 421 (*July*, 1947).—It is shown that the change in size vibration frequency of a polyatomic molecule up electronic excitation can be calculated if the excitat energy is known as function of the distance. This applied to benzene, for which this function is calcua both with the Heitler–London–Slater–Pauling metl and the molecular orbital method. Upon compari with experiment, it is found that both methods give right sign and order of magnitude for the change in s but the wrong sign for the change in frequency.

539.132 : 535.343.4 : 535.375.5 : 541.57 2

The vibration spectrum and molecular configuratio 1 : 4-dioxane. Ramsay, D. A. *Proc. Roy. Soc. A.*, 561–74 (*Sept.* 9, 1947).—The symmetry properties selection rules for the normal vibrations of 1 : 4-diox have been derived for all possible symmetries of molecule. The numbers of frequencies observed in infra-red spectrum of the vapour and Raman spectr of the liquid are shown to be inconsistent with structu of low symmetry. While the number of observed Ra

iencies do not distinguish between the "chair" and ar configurations, the number of observed infra-red iencies slightly favours the "chair" structure. The ibration frequencies of the ring have been calculated he "chair" structure using a simple valency force with 4 force constants, and good agreement is d with those 9 which have been experimentally rved. The remaining 3 frequencies agree satisorily with the corresponding assignments for cyclone. The stretching constants of the C–C and C–O ts, viz. $3{\cdot}7\times10^5$ and $4{\cdot}45\times10^5$ dynes/cm, were d to be the same as for cyclohexane and dimethyl respectively. [See Abstr. 2196 (1947)]. A.

132 : 539.16/.17 = 3 2947

a the excitation of molecular and crystal vibrations by reaction of nuclear processes on chemically bound s. Steinwedel, H., and Jensen, J. H. D. *Z. rforsch.*, **2a**, 125–32 (*March*, 1947) *In German.*— momentum and energy of the recoil of a nucleus lved in a nuclear reaction are distributed amongst atoms to which it is bound. The distribution amongst various degrees of freedom, the mean values and ad of these energies are calculated by classical and ntum mechanics, with substantially the same results, nolecules and crystals. G. J. K.

152.1 : 521.042 = 4 *see Abstr.* 2756

152.1 : 530.14 *see Abstr.* 2773–4,

152.1 : 539.172.3 2948

vestigations on a new nuclear potential. Lee, T. C. *J. Phys.*, **7**, 21–8 (*June*, 1947).—The potential een two nucleons suggested by Wang [Abstr. 2368 5)] is applied to find (1) the wave function of the nd state of the deuteron by the method of numerical zration, (2) the cross-section of the neutron-proton ering, and (3) the cross-section of the photo-ntegration of the deuteron by γ-rays. The results of ulation for the cross-sections are in fair agreement the experimental values. A.

152.1 : 539.185.7 2949

uclear level spacing deduced from the resonance rption of neutrons. Yang, J. Y. H. *Chin. J. Phys.*, **7**, (*June*, 1947).—The average nuclear level spacings of Ir and Au are estimated from the β-ray activities ced by the primary photo-neutrons emitted from a + Be source, measured by an Al Geiger–Müller nter. The saturated induced activities for the three ents are found to be $0{\cdot}665 \pm 0{\cdot}023$, $0{\cdot}982 \pm 0{\cdot}031$, $53 \pm 0{\cdot}021$ (no./sec) respectively. The estimation for average nuclear level spacings is made in accordance Breit–Wigner's one level formula, the results being 15 and 6 V. The spacing of Ir is probably somewhat -estimated since the values of the energy and orption coefficient of the resonance neutron group, in the estimation, are not very accurate. A.

152.2 2950

a the magnetic moment of the deuteron. Sachs, R. G. *Rev.*, **72**, 91–8 (*July* 15, 1947).—An attempt is made calculate the relativistic correction to the magnetic ment of the deuteron in order to determine the D probability from the accurately determined proton, eron, and neutron moments. It is found that the lting corrections depend strongly on the transforma- properties of the nuclear fields. If a scalar field is med the D state probability is estimated at 4·8% e for a vector field the corresponding estimate is %. The effect of a non-central tensor interaction is ded in these estimates. It is concluded that the netic moment cannot be used for a precision determination of the amplitude of the D function. The results also indicate that little can be said at this time concerning the question of the additivity of the intrinsic proton and neutron moments. A.

539.152.2 2951

Long range tensor forces and the magnetic moment of the deuteron. Primakoff, H. *Phys. Rev.*, **72**, 118–19 (*July* 15, 1947).—A theoretical study has been made of relativistic effects in the magnetic moment of the deuteron. It is concluded that the present unsatisfactory state of the theory of nuclear forces makes it impracticable to deduce the amount of D state admixture in the wave function of the deuteron ground state from the experimental value of $\mu_d - (\mu_p + \mu_n)$. The possibility that nuclear tensor forces have ranges considerably longer (and magnitudes considerably smaller) than the central forces is also discussed. A.

539.152.2 2952

Relativistic correction to the magnetic moment of the deuteron. Breit, G., and Bloch, I. *Phys. Rev.*, **72**, 135–40 (*July* 15, 1947).—The corrections are considered for a proton and neutron moving in each other's field. Two alternative equations are used as starting points for the calculations. One of these is an extension of the electrodynamic laws of interaction between charged particles. The other is typical of Hamiltonians giving rise to inverted (Thomas-term-like) vector spin orbit doublets and is an extension of the scalar field one-body equation. The calculations reported here show about the same degree of sensitivity of the relativistic correction of the deuteron's moment to the type of interaction assumed between particles as has been previously obtained in simplified considerations with a single particle model. It is concluded, therefore, that one cannot be sure of estimates of relativistic corrections to approximately their whole magnitude and that even the sign of the correction cannot be considered as certain. Considerations regarding additivity of nuclear moments involving an accuracy of much better than 0·01 nuclear Bohr magnetron appear to be obscured not only by the presence of relativistic corrections but also by the remoteness of sufficient knowledge concerning the interactions between particles which is essential for the determination of the effects of relativity. A.

539.153 : 538.114 2953

On ferromagnetism and the effective interatomic distances in metals. Galperin, F. M. *C.R. Acad. Sci. URSS*, **51** (*No.* 7) 511–12 (1946).—The radii R and r of the max. radial charge densities of the external S shell and internal incomplete d shell of transition metal atoms are calculated using Slater's formula [Abstr. 3938 (1930)]. For Cr, Mn, Fe, Co, Ni the values of $R + r$ closely approximate to the average interatomic distances in ferromagnetic combinations as determined by Forrer [Abstr. 3224 (1933)].

539.153 : 538.114 2954

On the atomic magnetic moments of Fe, Co and Ni. Galperin, F. M. *C.R. Acad. Sci. URSS*, **52** (*No.* 3) 211–13 (1946).—Slater's criterion for ferromagnetism [Abstr. 2726 (1930)] is combined with the results of a previous paper [Abstr. 2953 (1947)] to deduce a formula for the magnetic moment. The values calculated from this formula agree closely with the experimental values. L. S. G.

539.155.2 : 533.15 = 3 2955

The separation tube. VI. Isolation of the mixed molecule $N^{14}N^{15}$. Clusius, K., and Becker, E. W. *Z. Naturforsch.*, **2a**, 154–9 (*March*, 1947) *In German.*—

In the 82 m thermal diffusion plant used previously for the separation of O_2^{18} [*Z. Phys. Chem. A*, **193**, 274 (1944)] 1·5 l of N_2 containing 98·95% $N^{14}N^{15}$, 1·05% N_2^{15} and no detectable amount of N_2^{14} was produced from a starting material in the tube containing 3% N^{15}, with a material containing 1·8% N^{15} in the reservoir at the top. In contrast to the behaviour of O_2 no conversion of $N^{14}N^{15}$ into N_2^{14} and N_2^{15} took place at the central Pt wire, which was kept at a temperature of 700°C. H. L.

539.155.2 : 537.531 *see Abstr.* 2910

539.155.2 : 541.123.59 *see Abstr.* 2995

539.156 : 538.221 *see Abstr.* 2938

RADIOACTIVITY . NUCLEAR DISINTEGRATION NUCLEAR PARTICLES 539.16/.18

539.16.08 : 533.2 : 536.711 : 536.423.4 *see Abstr.* 2871

539.16.08 : 536.711 : 536.423.4 *see Abstr.* 2870

539.16.08 : 621.318.572 = 4 2956

Apparatus for particle counting using a G.M. counter. BERTHELOT, A. *J. Phys. Radium* (*Sér.* 8) **7**, 185–92 (*July*, 1946) *In French.*—[Abstr. 2479 B (1947)].

539.16/.17 : 539.132 = 3 *see Abstr.* 2947

539.163 = 4 2957

Formation of the solid body by radio-elements. CHAMIÉ, C. *J. Phys. Radium* (*Sér.* 8) **7**, 345–9 (*Dec.*, 1946) *In French.*—Experiments are described which show that the atoms formed by radioactive decay, in gaseous or liquid phase, of an element which is properly a solid, tend to associate in submicroscopic groups. If the dilution is sufficiently great to prevent atomic encounters, the individual atoms deposit on neighbouring bodies in order to reach the solid phase. It is suggested that the mechanism is not confined to radioactive deposits, but they are the only detectable manifestation of it. A. P. F.

539.163.1 = 4 2958

On the distribution of β-ray periods. NAHMIAS, M.-E. *J. Phys. Radium* (*Sér.* 8) **7**, 266–8 (*Sept.*, 1946) *In French.*—A plot of the number N of β-emitters in a range dx as a function of x, where 10^x = period in sec, has been made. The curve is quasi-Gaussian, with a peak at $x = 3{\cdot}5$. A fit to it is obtained for an "average" Sargent curve, with L between 1 and 2, under the assumption that the probability of a β-ray of energy E goes as $[1-(E/E_0)^2]$. E_0 (~ 6 MeV) represents a limiting β-ray energy. The smoothness of the curve suggests that the separate Sargent lines should be replaced by a domain. A. P. F.

539.163.1.08 2959

Application of the cathode ray oscillograph to measurements of short life-periods of radioactive sources. ROWLANDS, S. *Nature, Lond.*, **160**, 191 (*Aug.* 9, 1947).—The method was applied to the measurement of the ½-life of RaC′ [RaC(β)RaC′(α)RaD]. One counter, shielded from all but β-rays, starts the sweep of the c.r.o. and the output of another counter sensitive only to α-rays is recorded thereon; three sweep-times, 25, 50 and 500 μsec were used. Inspection of the distribution of signals from the second counter showed an exponential distribution in time, with a ½-value period of 140 μsec.

539.163.1/.2 2960

5·3 day isotope in element 61. PARKER, G. W., LANTZ, P. M., INGHRAM, M. G., HESS, D. C., JR., AND HAYDEN, R. J. *Phys. Rev.*, **72**, 85 (*July* 1, 1947).—A sample of element 61, whose predominant isotope was 147, was irradiated with slow neutrons. A 5·3 day product, identified by means of a mass spectrometer as 61^{148}, was produced by a (n, γ) reaction. The emitted β-particles had a max. energy of ~ 2·5 MeV and the accompanying γ-ray ~ 0·8 MeV. W. E. D.

539.163.2 = 3 2961

***K*-capture in naturally active lutecium.** FLAMMERSFELD, A. *Z. Naturforsch.*, **2a**, 86–9 (*Feb.*, 1947) *In German.*—It has been found that naturally radioactive Lu has two modes of decay. About ¼ goes by β^- emission to Hf^{176}, and ¾ by *K*-capture and subsequent γ-emission to the ground state of Yb^{176}. The *K*-radiation (~ 55 keV) and the γ-rays (260 keV) were identified by absorption measurements in Cd, Cu and Pb, and the branching ratio was deduced from the absolute counting rates for β- and γ-rays. A. P. F.

539.163.2 = 4 2962

Range and fine structure of α-particles from protoactinium. BACHELET, M., BOUISSIÈRES, G., AND TSIEN, S.-T. *J. Phys. Radium* (*Sér.* 8) **7**, 151–2 (*May*); 167–70 (*June* 1946) *In French.*—The shape of the last few mm of the Bragg curve suggested a fine structure in the energy spectrum. This was resolved, using a differential chamber, into a main group (80–85%) of 5·00 MeV (3·511 ± 0·010 cm range), and two small groups (8–10% each) of 4·72 and 4·69 MeV. Absolute values of energy and range were obtained by comparison with Po α-particles. A. P. F.

539.163.2 = 4 2963

Measurement of the mean range of Th α-particles by the photographic method. FARAGGI, H. *J. Phys. Radium* (*Sér.* 8) **7**, 353–6 (*Dec.*, 1946) *In French.*—The mean range is found to be 2·43 ± 0·03 cm. This is compared with previously published values [Abstr. 88 (1931), 2320 (1933), 1118 (1938)] of the extrapolated range, and is shown to be consistent with them if proper account is taken of the width of the Gaussian fluctuation curve. A. P. F.

539.163.2 : 537.533.72 2964

A magnetic-lens electron spectrometer: radiations from 5·3 year cobalt. MILLER, L. C., AND CURTISS, L. F. *Res. Nat. Bur. Stand., Wash.*, **38**, 359–64 (*March*, 1947).—An improved magnetic-lens spectrometer, similar in principle to that described earlier [Abstr. 265 (1945)] has been constructed. The structure, operation, and method of calibration, using a Th(B + C) deposit, are described. Measurements of the primary β-ray spectrum of Co and of the γ-ray spectrum converted in a U radiator confirm earlier reports [Abstr. 834 (1946)].

539.163.2 : 537.56 2965

A new determination of the mean ranges of the α particles from UI and UII. WYTZES, S. A., AND VAN DER MAAS, G. J. *Physica, 's Grav.*, **13**, 49–61 (*March* 1947).—A method of measurement is described, using a wide-aperture ionization chamber, which has the advantage that it can be used for weak sources with a large surface, and still has a high resolving power. The method was applied to U_I and U_{II} and it was found possible to separate these ranges completely. The mean ranges were measured relative to that of Po (38·44 mm) and were found to be (at 15°C, 760 mm Hg): U_I 27·02 mm; U_{II}, 32·58 mm.

539.163.2 : 539.172 2966

Cobalt 61 radioactivity. PARMLEY, T. J., AND MOYER, B. J. *Phys. Rev.*, **72**, 82 (*July* 1, 1947).—A 1·75 h activity associated with Co^{61} has been identified in the following reactions: Cu^{65} (n, αn) Co^{61} with fast neutrons; Ni^{64} (d, αn) Co^{61}; Ni^{64} (p, α) Co^{61}. Absorption of the β-particles in Al gave a value of 1·1 MeV for their max. energy. W. E.

64.1 : 537.133 : 778.3 2967

ge-energy relation for protons and α-particles in w Ilford "Nuclear Research" emulsions. LATTES, G., FOWLER, P. H., AND CUER, P. *Nature, Lond.*, 601–2 (*March* 1, 1947).—Curves are given of the "oing power" (ratio of mean range in standard air an range in emulsion) of the *B*1 emulsion for s of energies 2–13 MeV and also of α-particles various radioactive sources (emulsion range: ns, 80–900 μ; α-rays, 2·70 μ). A histogram of tracks from Be + *d* shows "peaks" whose widths ly slightly > that due to straggling, target thickness, o that resolution is adequate. Proton tracks can be minated from α-rays.

64.2 = 5 2968

ield theory of α-particles. DALLAPORTA, N. *Tecn.* **1**, 88–93 (*Nov.*, 1946) *In Italian.*—By analogy with 's theory of β-ray disintegrations, a (scalar) field y of α-particles is developed. The Geiger–Nuttall an be deduced by a perturbation method, thereby ating that the form of this law is independent of the ar structure. L. P.

65 2969

. the absorption coefficients of β-rays. TCHENG, , AND YANG, J.-T. *Chin. J. Phys.*, **7**, 29–47 (*June*, .—The absorption coefficients of β-rays from UX_2 RaE were completely studied. The complete ithmic absorption curve is not a really straight line a broken one consisting of several segments of ht lines. The slopes of the segments are greater as bsorbing screens are thicker. The values of the rption coefficients are not constant but can be varied rding to the conditions of measurement, e.g. the ance beneath the preparation, and the distance een the active preparation and the ionization ber window. A.

65.08 : 537.533.72 *see Abstr.* 2912

65.2 = 4 2970

β-disintegration. DAUDEL, R., BENOIST, P., UES, R., AND JEAN, M. *C.R. Acad. Sci., Paris*, **224**, –9 (*May* 19, 1947) *In French.*—The experimental rvation by Lecoin, Perey and Tsien San Tsiang *de Phys.*, **26**, 10 (1944)] of a β-disintegration taking with the emission solely of an X-ray and no electron amined theoretically, and it is shown that the pro- lity of entry of the emitted nuclear electron into an y level of the extra-nuclear part of the atom is high e electron energy is small, especially for the case of into the K-level. W. E. D.

66.8 2971

teraction of γ-rays with matter and the spectroscopy -radiation. LATYSHEV, G. D. *Rev. Mod. Phys.*, **19**, 45 (*April*, 1947).—A survey is given of the work of anov and his colleagues on the verification of the ulae derived from relativistic quantum mechanics he interaction of hard γ-rays with matter. Among subjects dealt with are: (*a*) the positron spectrum the pairs produced by internal conversion of γ-rays ving agreement with the theoretical work of Jaeger Hulme [Abstr. 1096 (1935)]; (*b*) probability of nal conversion and the assignment of a dipole or drupole nature to the radiation; (*c*) an investigation e emitted photo-electrons which, in conjunction with surements on total absorption, Compton scattering pair formation, enables a more accurate test of the e-Heitler formula for pair formation to be made. W. E. D.

539.166.9 = 4 2972

Some anomalies connected with the internal conversion of γ-rays. FRILLEY, M., SURUGUE, J., AND TSIEN, S.-T. *J. Phys. Radium* (*Sér.* 8) **7**, 350–2 (*Dec.*, 1946) *In French.*—Cases in which the internal conversion coefficient is very high or very low are discussed. It is pointed out that the present theory of the process cannot account for the latter. Other peculiarities concerning secondary electron and X-ray emission are briefly described. [See also Abstr. 3052 (1945)]. A. P. F.

539.172 2973

(*d*–*n*) reactions at 15 Mev. ROBERTS, R. B., AND ABELSON, P. H. *Phys. Rev.*, **72**, 76 (*July* 1, 1947).—The relative intensities of disintegration neutrons emitted at 0° and 90° to the impinging particle was measured to test the hypothesis that neutron emission is an evaporation process and should have no preferential direction of emission. For bombarding protons and α-particles this was found to be so, but with a deuteron beam the emitted neutron intensity was a max. in the forward direction, becoming more pronounced with increase of neutron energy. These results indicate that in this particular case the deuteron disintegrates on collision, the proton being captured and the neutron emitted. However, for this process theory predicts that the disintegration cross-section should increase with *Z*, whereas the Al cross-section ≫ either Cu or Au. W. E. D.

539.172 2974

Results of H^3 bombardment of Ag leading to Pd^{109}. KUNDU, D. N., AND POOL, M. L. *Phys. Rev.*, **72**, 101–8 (*July* 15, 1947).—H^3 was produced by (*d*, H^3) reaction in Be and Ag; the energy of the particles was ~ 10 MeV. The H^3 generated within Be produced the 13-hour Pd^{109} activity in Ag foils, as confirmed by chemistry. The reaction is believed to be $Ag^{109}(H^3, He^3)Pd^{109}$. Spurious (*n*, *p*) reaction was estimated and corrected for. The observed range of H^3 in different materials is discussed. The threshold for the H^3 reaction in Ag is roughly estimated to be between 1·1 and 1·5 MeV. A.

539.172 2975

On the time required for the fission process. WILSON, R. R. *Phys. Rev.*, **72**, 98–100 (*July* 15, 1947).—An experiment has been done to determine if any fissions were delayed by as much as 10^{-8} sec. Less than 5×10^{-5} of the fissions were delayed by this time. A.

539.172 : 539.163.2 *see Abstr.* 2966

539.172.3 : 539.152.1 *see Abstr.* 2948

539.172.4 = 3 2976

On the fragments to be expected in the fission of uranium. SEELMANN-EGGEBERT, W., AND STRASSMANN, F. *Z. Naturforsch.*, **2a**, 80–6 (*Feb.*, 1947) *In German.*—A survey is given of all fission product nuclei identified by the authors and their colleagues. Where a nucleus of given *Z* and *A* has not been observed, the likelihood of its being formed in fission, and the subsequent chances of detecting it, are discussed. A. P. F.

539.172.4 2977

Fission cross-section of Np^{237}. KLEMA, E. D. *Phys. Rev.*, **72**, 88 (*July* 1, 1947).—This was measured by comparison with U^{235}, and a curve of the results is shown. It shows a rise from zero at ~ 0·2 MeV up to a const. value of $\sim 1\cdot5\times10^{-24}$ cm² for energies > 1 MeV. W. E. D.

539.172.4 : 539.185 *see Abstr.* 2986

539.185 2978

Non-thermal neutron cascade. GROENEWOLD, H. J., AND GROENDIJK, H. *Physica, 's Grav.*, **13**, 141–52 (*March*, 1947).—The well-known energy distribution of

slow non-thermal neutrons cascading in paraffin has been generalized into an energy-time distribution, which determines the "tail" appearing after switching on or off the fast neutron source. A.

539.185 2979

The diffusion length of thermal neutrons in heavy water. SARGENT, B. W., BOOKER, D. V., CAVANAGH, P. E., HEREWARD, H. G., AND NIEMI, N. J. *Canad. J. Res. A*, **25**, 134–42 (*May*, 1947).—A continuous flux of thermal neutrons was passed into a large cylindrical tank of heavy water from a graphite column containing a source of photoneutrons. The neutron density in the tank was explored with small In detectors at selected points along two diameters at right angles in each of three horizontal planes and at 10-cm intervals along the axis of the tank. The transverse measurements were fitted to Fourier–Bessel series in which the amplitudes of the harmonics were relatively small. The effective radius derived from the transverse analysis was the same in the three planes. The relaxation length of the first component was found from the axial measurements. Corrections were applied for the absorption of neutrons in the axial detector tube, enclosed framework, and detectors, and in the light H in the water. The final value of the diffusion length of thermal neutrons in 100% D_2O is 171 ± 20 cm. Combining this with the known transport mean free path, the capture cross-section is $(0{\cdot}92 \pm 0{\cdot}22)\times10^{-27}$ cm² per molecule D_2O for neutrons of velocity 2 200 m/sec. A.

539.185 2980

The transport mean free path of thermal neutrons in heavy water. AUGER, P., MUNN, A. M., AND PONTECORVO, B. *Canad. J. Res. A*, **25**, 143–56 (*May*, 1947).—The transport mean free path of thermal neutrons in heavy water is determined from measurements of the neutron density in heavy water (99·4 atoms of D per 100 atoms of H) as a function of the distance from a Cd plate. This is linear, and when extrapolated, the density vanishes at a distance $d = 1{\cdot}64$ cm behind the plate. On the basis of transport theory it is known that $d = 0{\cdot}71 \times$ transport mean free path in the medium, which therefore = 2·4 cm in pure heavy water. The measurements of the neutron density show that it falls below the straight line as the Cd surface is very closely approached, in agreement with transport theory. A.

539.185 2981

Spatial distribution of neutrons in hydrogenous media containing bismuth, lead, and iron. MUNN, A. M., AND PONTECORVO, B. *Canad. J. Res. A*, **25**, 157–67 (*May*, 1947).—The spatial distributions of thermal neutrons (as measured by Dy detectors) and of resonance neutrons (In detectors protected by Cd) have been investigated in several media, consisting of water and heavy elements in a heterogeneous arrangement, with two different neutron sources (Ra-α-Be and Ra-γ-Be). The experimental results are summarized in tables where the values of the mean square distances from the source of neutrons are given, for the various media, detectors, and sources used. It was found that among all the media investigated, a mixture of water and Fe is the most efficient shield for neutron-generating machines such as piles and cyclotrons. A.

539.185 2982

A bent crystal neutron spectrometer and its application to neutron cross-section measurements. SAWYER, R. B., WOLLAN, E. O., BERNSTEIN, S., AND PETERSON, K. C. *Phys. Rev.*, **72**, 109–15 (*July* 15, 1947).—To increase the useful intensity and hence the energy range over which measurements can be made with good resolution, the Cauchois type bent crystal spectrometer was adapted for use in neutron diffraction. The instrument gives good resolution of neutron resonance peaks of ~0·1 e width at ½ max. at energies up to 1 eV, and work can be done at higher energies with a corresponding loss resolution. As samples of work done with this instrument, absorption measurements on Cd and Ir a discussed.

539.185 29

A thermal neutron velocity selector and its applicati to the measurement of the cross section of boron. FERN E., MARSHALL, J., AND MARSHALL, L. *Phys. Rev.*, 7 193–6 (*Aug.* 1, 1947).—A mechanical velocity selec for neutrons < 0·3 eV is described, consisting essential of a sandwich pile of alternate Cd and Al foils, rotat as a shutter in the neutron beam about an axis paral to the plane of the foils. Using it, the cross-section of for neutrons of 2 200 m/sec velocity was found to 703×10^{-24} cm².

539.185 = 3 29

Application of neutron diffusion through interfaces to t determination of effective cross-sections. RAETHER, *Z. Naturforsch.*, **1**, 367–71 (*July*, 1946) *In German.* If a stream of thermal neutrons is passed through t interface between two media, the ratio of the free pat can be obtained from the ratio of density gradients a relation due to Heisenberg. Using H_2O and D_2 and assuming the effective cross-section of H to 45×10^{-24} cm², experiment shows that of D to $(5{\cdot}6 \pm 0{\cdot}3)\times10^{-24}$ cm², in good agreement with t value obtained from the determination of absorpti coeffs. of D_2O layers. A. J.

539.185 : 537.591.5 29

Distribution of neutrons in the atmosphere. AGNE H. M., BRIGHT, W. C., AND FROMAN, D. *Phys. Rev.*, 203–6 (*Aug.* 1, 1947).—Measurements on the distributi of neutrons in the atmosphere have been made to altitude of 36 600 ft. Observations were made w counters filled with BF_3 containing 82% of B^{10}, in vario shielding geometries. Counters were used bare (shielding), Cd-covered, B-covered, and surrounded w a layer of paraffin. The counting rates of all counte varied in the same way with altitude in the pressure ran from 20 to 50 cm Hg. Within this pressure range t intensity I is given quite accurately by the relati $I = I_0e^{-0{\cdot}083p}$, where p is expressed in cm of Hg. T counting equipment was carried in a B-29 type aircraft.

539.185 : 539.172.4 29

Directional properties of fission neutrons. WILSON, R. *Phys. Rev.*, **72**, 189–92 (*Aug.* 1, 1947).—An experime has been performed to measure the correlation betwe direction of neutron and fragment in the fission proce The results are consistent with the isotropic evaporati of neutrons from the moving fragments.

539.185.7 29

Scattering of fast neutrons by helium. HALL, T. AND KOONTZ, P. G. *Phys. Rev.*, **72**, 196–202 (*Aug.* 1947).—Measurements have been made of the angu distribution of He recoils for incident neutrons of energ from 0·6 to 1·6 MeV. The distribution curves a permit estimates of the total cross-section in this ener range. The results confirm the existence of a cro section peak of $\sim6{\cdot}8\times10^{-24}$ cm² around 1 MeV a indicate, under the assumption of s- and p-wave scatter only, that the peak is double. But preliminary attem to fit the data to Bloch's detailed theory of s- and scattering with a split p-level have not been successf and the sign of the postulated splitting is not establish

35.7 2988
lision cross sections of carbon and hydrogen for fast ons. SLEATOR, W., JR. *Phys. Rev.*, **72**, 207–19 1, 1947).—Experiments are described by means of the cross-sections were determined for neutrons different energies between 6 and 22 MeV. Data be taken on groups of neutrons having energies an interval small compared to the neutron energy, t any energy produced by a heterogeneous source. esults are consistent with those of other observers 4 neutron energies in this range which have been ously investigated. A comparison with various ies shows that at high energies the observed H cross- ns are ~ 10% > pure *S*-wave cross-sections com- l on the basis of a square well interaction between on and proton, and that they agree very well with "symmetrical" theory of Rarita and Schwinger tr. 1356 (1941)]. A.

85.7 = 3 2989
itron capture of uranium in various energy regions. RWEIN, K. *Z. Naturforsch.*, **2a**, 73–9 (*Feb.*, 1947) *erman.*—A study of the capture process, using the bsorption and B absorption methods, pointed to the ence of a broad absorption band (several hundred ide) for neutron energies of a few hundred eV, in ion to an isolated resonance at 7·5 eV. The band cribed to numerous closely spaced resonances. A. P. F.

185.7 : 539.152.1 *see Abstr.* 2949

STRUCTURE OF SOLIDS 539.2

21 : 532.623 : 548.713 *see Abstr.* 3007

211 : 539.26 : 539.4.016 2990
easurement of depth of cold work on X-ray spectro- r. FIELD, M. *Rev. Sci. Instrum.*, **18**, 451–3 (*June*,).—The intensity of reflection from a metal surface nds on the number of crystal grains in a reflecting ntation. When the metal surface is rotated about a endicular axis not intersecting the X-ray beam the sity varies periodically, the variation being an asing function of the grain size. The method is most ble for grain sizes > 10^{-4} cm, and is thus comple- tary to that based on diffraction broadening. The h of cold work can be determined by etching off essive layers until the amplitude of variation no er increases. A Geiger-counter spectrometer is venient for the purpose. A. J. C. W.

211 : 539.26 : 539.4.016 = 3 2991
a worked metal surface microcrystalline or amorphous? NERT, W., AND RAETHER, H. *Z. Naturforsch.*, **1**, -13 (*Sept.*, 1946) *In German.*—Comparison of the i of the electron-diffraction rings produced by cold- ked and crystalline Sb, Se and Bi with those found by r workers for vitreous Sb and Se and liquid Se and Bi cates that the cold-worked surface is finely crystalline, not amorphous or liquid. A. J. C. W.

215.2 : 621.775.7 2992
ate of sintering of copper powder. SHALER, A. J., AND WULFF, J. *Phys. Rev.*, **72**, 79–80 (*July* 1, 1947).—Frenkel's theory [*J. Phys., USSR*, **9**, 392 (1945)] has been extended to derive expressions for rate of shrinkage, at various temps., of powder aggregates containing many pores of uniform size. There is qualitative agreement on the sintering of uniform spherical Cu particles, but the experimental value of the surface tension of solid Cu leads to a viscosity coefficient in disagreement with that predicted by the Frenkel theory, using experimental values of the self-diffusion constant. W. E. D.

539.215.4 : 535.434 *see Abstr.* 2855–6

539.215.4 : 539.26 *see Abstr.* 2994

539.217 2993
The hole theory of diffusion. WYLLIE, G. *Proc. Phys. Soc., Lond.*, **59**, 693–9 (*July*, 1947).—It is shown that in a dilute substitutional solid solution of one metal in another the diffusion of the solute atoms is determined by the compound activation energy $\varepsilon_A + \varepsilon_{ABA}$ where ε_A is the energy necessary for the formation of a hole next to a dissolved atom and ε_{ABA} the energy of activation for the hole to make one jump round that atom, provided $\varepsilon_{ABA} - \varepsilon_{BB} \gg kT$, where ε_{BB} is the energy of activation for the hole to diffuse away from the dissolved atom. This mechanism provides an explanation of the cases where diffusion of a foreign metal atom in a lattice has a lower activation energy than self-diffusion in the same lattice (e.g. Au in Pb). However, the assumption of next-neighbour interactions made in this paper does not correspond to the facts of metallic structure. The statistical argument is not invalidated by this, but the calculation of the energies involved becomes a difficult problem in quantum mechanics which has not yet been solved. A.

539.23 : 535.39 = 4 *see Abstr.* 2852

539.23 : 535.393 = 4 *see Abstr.* 2853

539.23 : 537.311.31 *see Abstr.* 2890

539.23 : 537.33 = 4 *see Abstr.* 2902

539.26 : 539.215.4 2994
Method of correcting low angle X-ray diffraction curves for the study of small particle sizes. DUMOND, J. W. M. *Phys. Rev.*, **72**, 83–4 (*July* 1, 1947).—After reference to the method of Guinier [Abstr. 4348 (1939)], the author suggests a second method by placing the sample between the crystals of a two-crystal spectrometer. The note then gives a procedure for correcting the experimental curves of both methods so as to give the true radial intensity distribution. W. E. D.

539.26 : 539.4.016 : 539.211 *see Abstr.* 2990

539.26 : 539.4.016 : 539.211 = 3 *see Abstr.* 2991

ELASTICITY . STRENGTH . RHEOLOGY 539.3/.8

539.374 : 539.388.8 : 536.764 *see Abstr.* 2886

539.388.8 : 539.374 : 536.764 *see Abstr.* 2886

539.4.016 : 539.26 : 539.211 *see Abstr.* 2990

539.4.016 : 539.26 : 539.211 = 3 *see Abstr.* 2991

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM 541.121/.123

123.2 : 531.19 *see Abstr.* 2781

123.59 : 539.155.2 2995
eparation of the nitrogen isotopes by the exchange ction between ammonia and solutions of ammonium nitrate. KIRSHENBAUM, I., SMITH, J. S., CROWELL, T., GRAFF, J., AND MCKEE, R. *J. Chem. Phys.*, **15**, 440–6 (*July*, 1947).—The fractionation factor was determined as a function of the dissolved NH_3 content. It was found that $\alpha = -0{\cdot}029M + 1{\cdot}034$ for a stock solution containing 59·3–59·6% NH_4NO_3, where α is the frac-

tionation factor at 25°C and M the fraction (moles NH_3)/(moles NH_3 + moles NH_4NO_3), in solution. From these data, the equilibrium constant for $N^{14}H_4^+(sol)+N^{15}H_3(gas) \rightleftharpoons N^{15}H_4^+(sol)+N^{14}H_3(gas)$ was calculated to be 1·034; for $N^{14}H_3(sol) + N^{15}H_3(gas) \rightleftharpoons N^{15}H_3(sol) + N^{14}H_3(gas)$ it is 1·005. Vapour pressure and density data were determined for the NH_3-NH_4NO_3 solutions as a function of the NH_3 concentration. A.

REACTION KINETICS 541.124/.128

541.124 : 532.74 *see Abstr.* 2793

541.126 : 536.71 : 533.75 *see Abstr.* 2798

ADSORPTION 541.183

541.183.5 : 548.0 : 537.58 = 3 *see Abstr.* 2924

541.183.56 : 536.48 2996

Anomalous adsorption of helium gas on glass, between 3 and 1·7°K. KISTEMAKER, J. *Commun. K. Onnes L Leiden* (*No.* 271*b*). *Physica, 's Grav.*, **13**, 81–7 (*Ma* 1947).—Adsorption measurements were made from to 3°K, with pressures from 4 to 16 mm Hg, th pressures corresponding to between 9 and 99% of vapour pressure. The differential method with X- shadowgraphs was used [Abstr. 2783 (1946)]. number of adsorbed layers varied from ~ 5 to 31, it seems probable that this is the pre-formation of liquid He film.

CHEMICAL STRUCTURE 541.4/.6

541.57 : 535.343.4 : 535.375.5 : 539.132 *see Abstr.* 294

CHEMICAL ANALYSIS 543/545

545.827 : 537.534.72 *see Abstr.* 2916

CRYSTALLOGRAPHY 548

548.0 : 537.226 *see Abstr.* 2887

548.0 : 537.228.1 2997

Barium titanate crystals. KAY, H. F., AND RHODES, R. G. *Nature, Lond.*, **160**, 126–7 (*July* 26, 1947).—Crystals up to ~ 2 mm have been produced, and some of their properties are briefly described. They are piezo-electric, and consist of twins in various arrangements. The twinning arrangement is sensitive to electrical and mechanical stresses, particularly near ~ 120°C, where a transition from tetragonal (<120°C) to cubic symmetry takes place without change of external form; such stresses cause a reorientation of twins to reduce the internal stresses. [See Abstr. 2887 (1947)].

548.0 : 541.183.5 : 537.58 = 3 *see Abstr.* 2924

548.735 2

Application of the method of steepest descents to X-structure analysis. BOOTH, A. D. *Nature, Lond.*, 1 196 (*Aug.* 9, 1947).—If a set of observed structure fact F_0 (h, k, l) is given, then a set of atomic co-ordinate called a correct structure if: $R = \Sigma(|F_{obs}| - |F_{calc}|)$, $R_2 = \Sigma(F^2_{obs} - F^2_{calc})^2$, is a min. The procedure varying a set of trial atomic parameters x_{rj} to arr most rapidly at the min. value of R_2 is outlined. T method has proved much shorter than the Fou method.

548.735 2

New refinement technique for X-ray structure analy BOOTH, A. D. *J. Chem. Phys.*, **15**, 415–16 (*June*, 1947) See Abstr. 2998 (1947).

GEOPHYSICS 55

550.381 3000

Frenkel's views on the origin of terrestrial magnetism. SCHLICHTER, L. B., AND BULLARD, E. C. *Nature, Lond.*, **160**, 157 (*Aug.* 2, 1947).—Frenkel's theory [*C.R. Acad. Sci. URSS*, **49**, 98 (1945)] ascribing the earth's magnetism to electric currents induced in the liquid metallic core of the earth by thermal convection, is criticized on the grounds that he has neglected turbulence which would reduce the motion.

550.385 : 523.72 *see Abstr.* 2761

550.386 : 523.75 = 4 *see Abstr.* 2762

551.465.018.1/.2 : 621.396.944 : 532.59.08 *see Abstr.* 2789

METEOROLOGY 551.5

551.508.79 : 535.33.072 *see Abstr.* 2828

551.510.535 : 621.396.11 3

Radiation angle variations from ionosphere measu ments. HALLBORG, H. E., AND GOLDMAN, S. *RCA R* **8**, 342–51 (*June*, 1947).—[Abstr. 2568 B (1947)].

551.510.535 : 621.396.11.029.56 3

2-Mc sky-wave transmission. PIERCE, J. A. *E tronics*, **19**, 146–53 (*May*, 1946).—[Abstr. 2571 B (194

551.574 : 536.42 *see Abstr.* 2868

551.593 : 523.745 : 525.75 = 4 *see Abstr.* 2763

551.594.9 : 621.396.99 : 523.5 *see Abstr.* 2758–9